1969 *Cadillac* SHOP MANUAL

1969 CADILLAC SHOP MANUAL

Service information pertaining only to those features that are exclusive to the Fleetwood Eldorado is provided at the back of the individual sections in this manual. All other service procedures and recommendations for the Eldorado are the same as those described in the forward portion of the individual sections.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

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CADILLAC MOTOR CAR DIVISION
General Motors Corporation
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GENERAL INFORMATION, MAINTENANCE AND LUBRICATION

Foreword

This Shop Manual has been prepared by the Service Department of the Cadillac Motor Car Division to aid in servicing 1969 model Cadillac automobiles. It is intended primarily for Servicemen who are familiar with earlier model Cadillacs. It includes complete information on service procedures and specifications pertaining to all 1969 model Cadillac cars.

Arrangement of the Manual

The title page contains a rapid reference section index with headings corresponding to the page tabs at the beginning of each section. A Table of Contents is provided at the beginning of each section that contains more than one major subject. A complete alphabetical index is located at the back of the manual.

The section sequence used in this manual has been arranged to conform with the Universal Parts Classification (U.P.C.) grouping adopted by General Motors Corporation, and used in the Shop Manuals of other GM car lines. This sequence will enable service personnel of dual dealerships to locate information in technical manuals more easily.

The individual sections include a general description of components and systems, service adjustments and replacement procedures, diagnostic information, and illustrations. An illustrated list of special tools, a torque requirement chart, and specifications are also provided at the end of each section.

Service information pertaining only to those features that are exclusive with the Fleetwood Eldorado, is provided at the back of the individual sections in the manual. For Eldorado service procedures and recommendations not listed, refer to the forward part of the appropriate section, as these service procedures are similar to those on other cars.

GENERAL INFORMATION

Body Style Number

Four standard series of cars with 11 body styles are included in the 1969 Cadillac line. In addition, there is a Commercial Chassis. The numeral six is used as the first digit in designating all 1969 Cadillac body style numbers. The first three digits of the body style number indicate the series designation, the last two digits indicate the body style. Specifications are shown on Page 0-3.

Vehicle Identification Number

Each Cadillac automobile or chassis carries a Vehicle Identification Number. The number is used in license and insurance applications and in general reference to the automobile. An eight digit Vehicle Identification Number is stamped on a steel plate located on the cowl bar in the lower left hand corner of the windshield where it is visible from outside the car. The letter indicates the sales code, the first digit of the number (9) indicates the model year, and the last six digits indicate the sequence in which the car was built (see Page 0-3). The last six digits of the first 1969 Cadillac automobile manufactured is number 100001, regardless of series or style; subsequent cars built are numbered in numerical order. The Vehicle Identification Number, less the sales code letter, is also located on the rear upper portion of the cylinder block behind the intake manifold, and on the left side of the transmission, Fig. 0-1.

On engines built to low compression specifications, the letters L.C. are stamped immediately following the Vehicle Identification Number at the rear of the cylinder block.

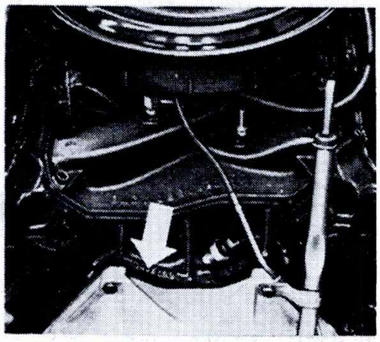
During production, some engines are built with one or more cylinders that have a .010" oversize bore. These engines are identified by an asterisk immediately following the Vehicle Identification Number at the rear of the cylinder block.

Identification Numbers

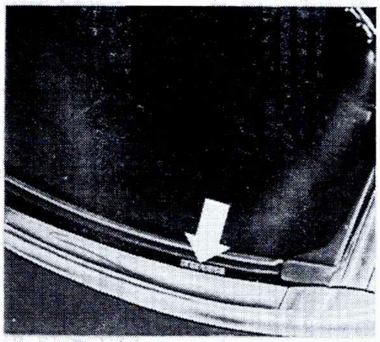
Locations of identification numbers on various units are shown in Fig. 0-1. The identification number on the unit should always appear on forms sent to the Central Office such a PIR's, Claim Tags, Pre-Delivery Reports and, when required, on AFA's. The Vehicle Identification Number and the transmission unit number are particularly important when reporting product information on these components.

Body Name Plate

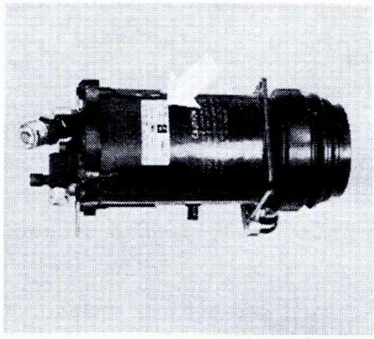
A body name plate, Fig. 0-2, is attached to the top surface of the shroud at the left, under the hood, near the cowl. The name plate carries the



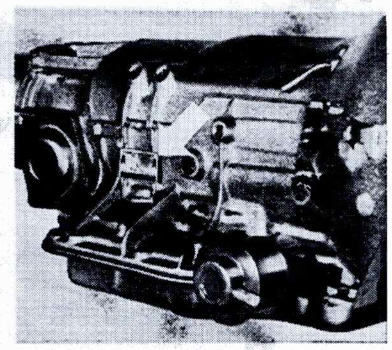
VEHICLE IDENTIFICATION NUMBER LOCATED ON PAD AT REAR OF CRANKCASE BEHIND INTAKE MANIFOLD.



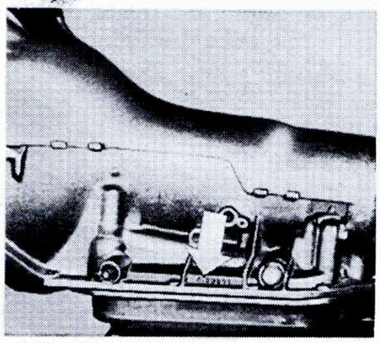
VEHICLE IDENTIFICATION NUMBER LOCATED ON PLATE RIVETED TO COWL BAR IN THE LOWER LEFT HAND CORNER OF THE WINDSHIELD.



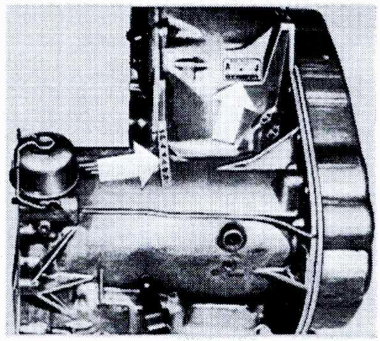
A/C COMPRESSOR SERIAL NUMBER LABEL LOCATED ON REAR PORTION OF COMPRESSOR HOUSING.



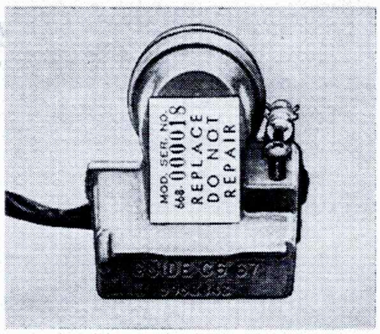
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON RIGHT SIDE OF CASE (EXCEPT 693).



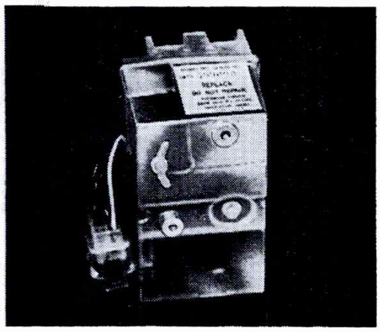
VEHICLE IDENTIFICATION NUMBER LOCATED ON LEFT SIDE OF TRANSMISSION CASE (EXCEPT 693).



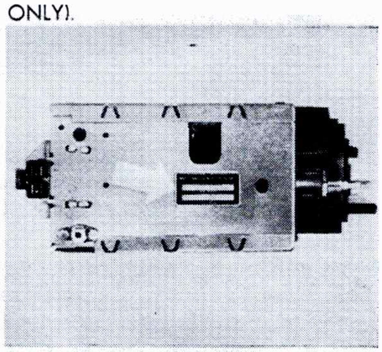
TURBO HYDRA-MATIC TRANSMISSION UNIT NUMBER PLATE LOCATED ON LEFT SIDE OF CONVERTER HOUSING. VEHICLE IDENTIFICATION NUMBER LOCATED ON VERTICAL SUPPORT PAD ON LEFT SIDE OF TRANSMISSION (693 ONLY).



GUIDE-MATIC PHOTOTUBE AND AMPLIFIER SERIAL NUMBER LABEL LOCATED ON BACK OF UNIT.



TWILIGHT SENTINEL AMPLIFIER SERIAL NUMBER LABEL LOCATED ON COVER OF UNIT.



RADIO SERIAL NUMBER TAG LOCATED ON RIGHT SIDE OF TUNER.

Fig. 0-1 Unit Number Locations

style number, trim number, body number and paint number in the areas indicated by ST, TR, BODY and PAINT.

The first two digits of the style number (ST) indicate the model year while the remaining five digits indicate the body style.

The numbers following TR indicate the interior trim color and the letter indicates the seat type.

The body number consists of three letters indicating the assembly plant and six digits indicating the sequence in which the body was built.

The first two digits of the paint number indicate color of the body shell and chassis sheet metal; the next digit indicates color of convertible and fabric tops.

The number-letter code at the upper left indicates date of assembly (month-week).

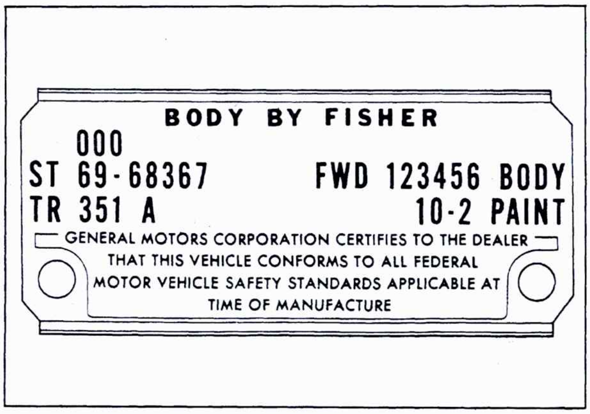


Fig. 0-2 Body Name Plate

GENERAL DESCRIPTION AND SPECIFICATIONS

Description	Style Number	Sales Code	Vehicle Identification Number	Wheelbase (Inches)	Overall Length (Inches)	Overall Height (Inches)	Maximum Width (Inches)	Tread Width Front	Tread Width Rear
Fleetwood Sixty Special Sedan	68069	M	M9100001	133.0	228.5	56.6	79.94	63.0	63.0
Fleetwood Brougham Sedan	68169	P	P9100001	133.0	228.5	56.7	79.94	63.0	63.0
Calais Hardtop Sedan	68249	N	N9100001	129.5	225.0	54.4	79.94	63.0	63.0
Calais Coupe	68247	G	G9100001	129.5	225.0	54.4	79.94	63.0	63.0
Hardtop Sedan De Ville	68349	B	B9100001	129.5	225.0	54.4	79.94	63.0	63.0
Coupe De Ville	68347	J	J9100001	129.5	225.0	54.4	79.94	63.0	63.0
De Ville Convertible	68367	F	F9100001	129.5	225.0	54.3	79.94	63.0	63.0
Sedan De Ville	68369	L	L9100001	129.5	225.0	55.5	79.94	63.0	63.0
Fleetwood Eldorado	69347	H	H9100001	120.0	221.0	53.8	79.94	63.5	63.0
Fleetwood Seventy-Five Sedan	69723	R	R9100001	149.8	245.3	58.1	79.94	63.0	63.0
Fleetwood Seventy-Five Limousine	69733	S	S9100001	149.8	245.3	58.1	79.94	63.0	63.0
Commercial Chassis	69890	Z	Z9100001	156.0	250.5	--		63.0	65.0

Towing Instructions

1969 Cadillac cars cannot be started by pushing, and this procedure should never be attempted. If the car cannot be started in the normal manner, or by use of jumper cables, it should be towed to the nearest authorized Cadillac service facility.

When towing a 1969 Cadillac, the transmission should be in Neutral (N) and the engine ignition should be "OFF", but the Anti-Theft Steering Column Lock should not be in the "Lock" position.

Since the Anti-Theft Steering Column Lock locks the steering and shift mechanisms as well as the ignition system, special provisions are necessary for towing a vehicle when the switch is in "lock" position. (When the key is not available). It will be necessary to place a dolly under the rear wheels and tow the vehicle with the front end raised.

Proper lifting and towing equipment is necessary to prevent damage to the vehicle during the towing operation.

a. Except Eldorado

If the transmission, drive line, or axle do not have a malfunction, the vehicle may be towed in Neutral "N" at speeds up to 35 MPH for distances up to 50 miles. For higher speeds or extended distances, it is recommended that the propeller shaft be disconnected or rear wheels be off the ground.

If towing requires raising front or rear of car, wheels should be lifted just slightly off the ground. When towing with rear wheels raised, lock the steering wheel with front wheels in a straight ahead position. This may be done by turning the ignition switch to the "LOCK" position.

Before towing, check transmission fluid level. Fluid level must be above full mark on the dip stick with engine "OFF". Always tow car with transmission shift lever in Neutral position.

b. Eldorado Only

It is recommended that the Fleetwood Eldorado

be towed with the front wheels off the ground. In case vehicle damage in the rear wheel area will not permit towing with the front wheels raised, the car can be towed with the rear wheels off the ground. If towing requires raising the rear of the car, the wheels should be raised just slightly off the ground and the steering wheel should be secured with front wheels in straight ahead position. The ignition switch cannot be in the "LOCK" position. Always place the transmission shift lever in Neutral "N" position when towing the car with the rear wheels off the ground. The car can be towed at speeds up to 35 MPH for distances up to 50 miles.

Car Storage Preparation

Certain precautions must be taken when placing a car in "dead" storage for extended periods of time. Listed below are the recommendations to be followed when storing a car for 30 days or less, and for a period of 30 days to 12 months.

a. Car Storage Preparation—30 Days or Less

1. Wash car and inflate tires to 40 pounds pressure.
2. Provide proper cooling system protection.
3. Run engine until completely warmed up; then drain and refill with fresh oil which, according to the label on the can is: (1) intended for service "MS" and (2) passes car makers' tests or meets General Motors Standard GM 6041-M.
4. Run engine again with fresh oil until completely warmed up; drive car to place of storage and park. Do not restart again until end of storage period.
5. Be sure parking brake is in released position and car is on level surface.
6. If car is to be stored in a hot area, the fuel tank, lines, pump, filter and carburetor should be drained.
7. Disconnect battery and prevent battery from discharging or freezing by keeping it fully charged.

b. Car Storage Preparation—30 Days to 12 Months

1. Wash car.
2. Run engine until completely warmed up; then drain and refill with fresh oil which according to the label on the can is: (1) intended for service "MS," and (2) passes car makers' tests or meets General Motors Standard "GM 6041-M".
3. Run engine again with fresh oil until completely warmed up; drive car to storage area. Run engine at 2,000 rpm in neutral and pour engine oil into carburetor. After about a pint has been added, pour oil fast enough to stall engine.
4. Be sure parking brake is in released position and car is on level surface.
5. Drain gasoline from fuel tank.
6. Disconnect all fuel lines blow out, and reconnect.
7. Remove carburetor, clean thoroughly, and store in plastic bag.
8. Remove fuel pump, clean, and store with carburetor. Remove filter assembly and discard.

NOTE: Tape fuel pump, carburetor and gas line openings closed with masking tape.

9. Drain coolant from radiator, cylinder block and heater cores.
10. Lower windows 1/2 inch to stop humidity "sweat" and mold.
11. Remove battery from car, and have charge maintained during period car is stored.
12. Put car up on chassis stands so that tires are off the floor.
13. Apply 10W engine oil to exterior bright surfaces.
14. When car is taken out of storage, install a new fuel filter, check brake system for leaks, and bleed brakes. Clean spark plugs and regap. Most important of these recommendations is proper cooling system protection, and refraining from starting the engine and running it for short periods during the storage interval. Running the engine in this manner would cause crankcase condensation and possible acid contamination of the oil. A car should never be stored with used oil in the crankcase.

Special consideration should be given when conditions of high humidity, high temperature, or outdoor storage are encountered. Local experience will dictate the additional protection measures in each particular case.

Hoist Recommendations (Except 693)

The preferred type of hoist for lifting 1969 Cadillac cars is one that engages the front suspension and rear axle, or all four wheels.

The front lower suspension arm is designed to provide a flattened portion on the flange of the arm for use with lifting equipment that engages the suspension system. When using lifting equipment of this type, make certain that the car is properly centered over the hoist and that the hoist arms are positioned under the flattened portion of the flange, Fig. 0-3, outboard of the safety lo-

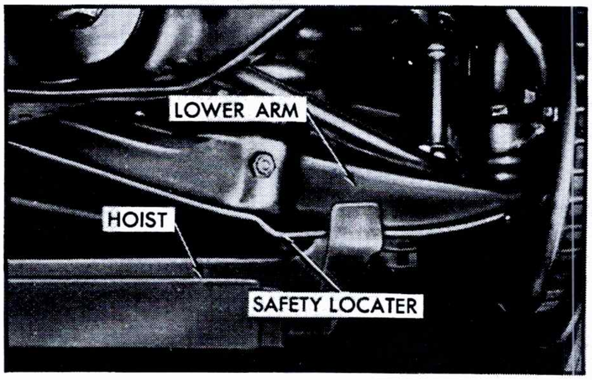


Fig. 0-3 Positioning Car on Hoist

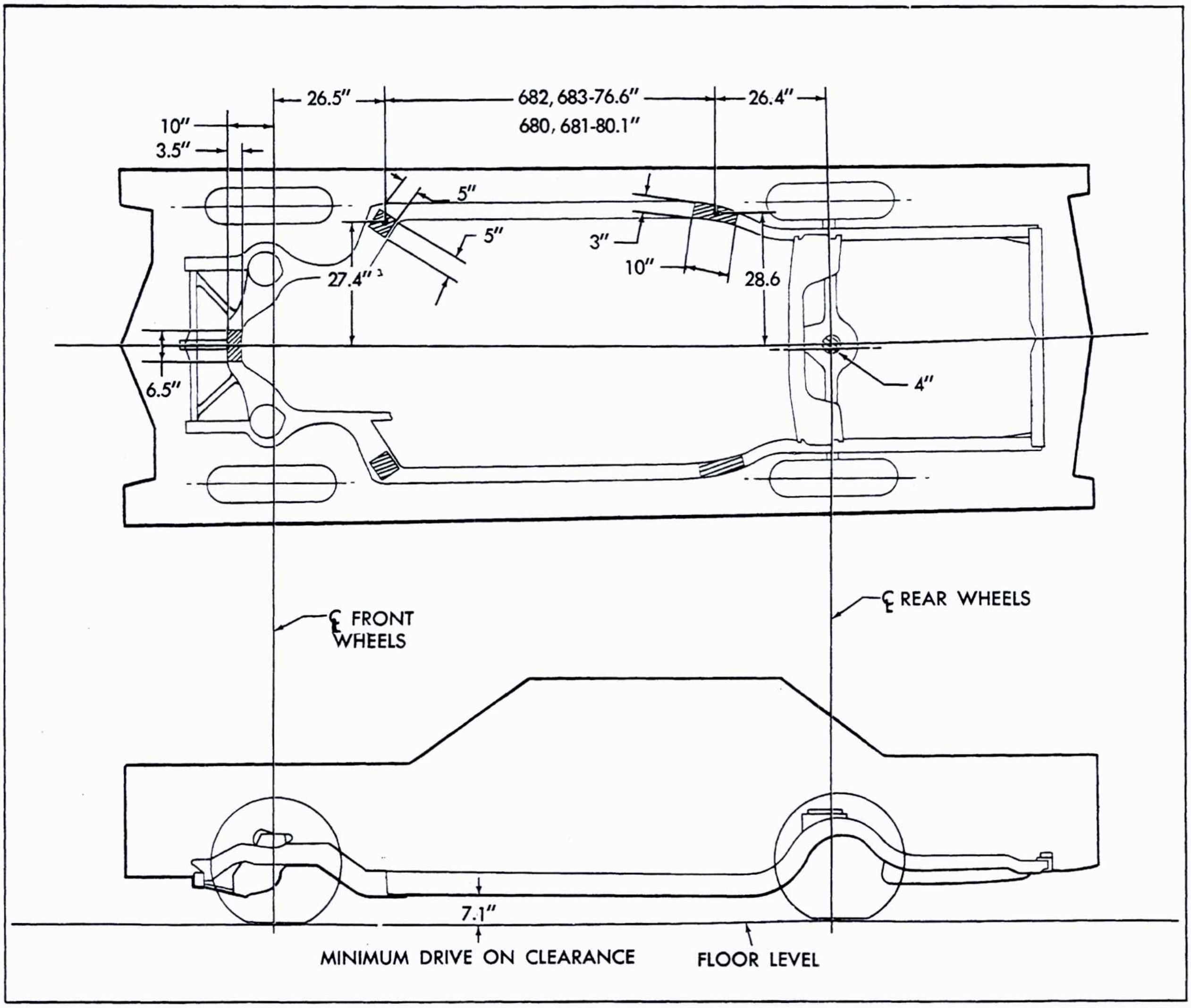


Fig. 0-4 Hoist Position (Except 693)

caters. If the hoist arms are not properly positioned in relation to the lower support arms, damage to the steering linkage or brake lines could result, or the car may shift on the hoist.

If a frame-engaging hoist is used, certain precautions must be observed. The shaded areas, Fig. 0-4, indicate the only acceptable positions for lift pads. Pads must be used in these areas with maximum surface contact and must not contact any part of the frame not indicated.

Do not use a frame-engaging hoist to raise the Fleetwood Seventy-Five sedan and limousine or the commercial chassis.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should the rear end of car be raised so that rear suspension is in rebound position while disconnecting shock absorbers.

Hoist Recommendations (693 Only)

The preferred type of hoist for lifting the 1969 Fleetwood Eldorado is one that engages the front suspension and rear axle or all four wheels.

CAUTION: When raising the car on a suspension type hoist, a special adapter may be required on some type hoists to prevent damage to the rear axle as the center line of the

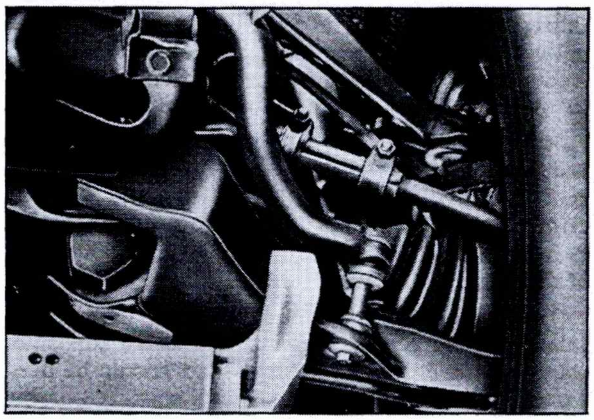


Fig. 0-5 Front Hoist Saddle Position - 693

rear axle is behind the center line of the rear wheels.

Use of a suspension-engaging hoist requires that certain procedures be observed.

Be sure front hoist saddle adapters engage lower suspension arm just inboard of stabilizer linkage (both sides), Fig. 0-5, to prevent damage to steering linkage. At the rear, Fig. 0-6, place "saddles" of hoist in maximum "IN" position to prevent damage to Automatic Level Control bracket, fuel and brake lines.

Make sure that hoist saddle engages one flange of the rear axle channel when the Eldorado is in position to be hoisted, Fig. 0-6, and does not straddle both flanges.

If a frame engaging hoist is used, certain precautions must also be observed.

Make sure that hoist adapters and "tabs" are in lowered position before driving on or off the lift.

Position hoist adapter "tabs" in raised position to obtain maximum possible height between frame and hoist.

Be sure to position adapter tabs in exact locations shown in shaded areas of Fig. 0-7 and make sure the centerline of the door is behind the centerline of the lift post for proper weight distribution.

An additional precaution of using <u>two</u> floor stands under the <u>front</u> frame cross member of the Eldorado is recommended when heavy mechanical operations are to be performed. Be sure to remove these stands before attempting to lower the vehicle.

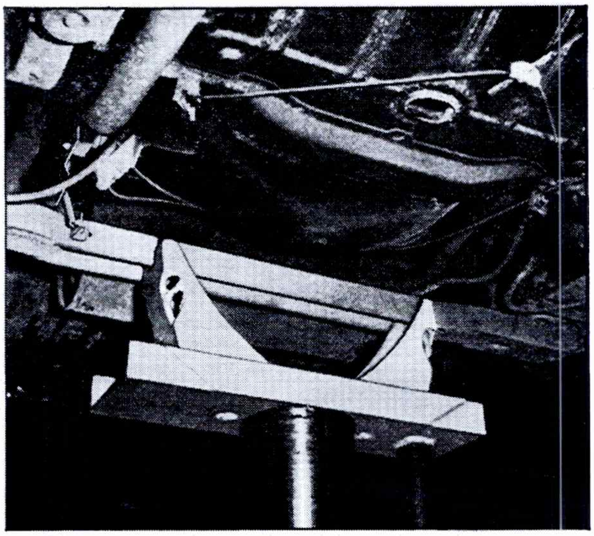


Fig. 0-6 Rear Hoist Saddle Position - 693

If a drive-on hoist is used, be sure the center line relationship as stated above is also applied (Fig. 0-7).

When supporting the Fleetwood Eldorado with a floor jack or jack stands, the supports should be placed at the suspension lift points or the frame contact lift points. The Fleetwood Eldorado should never be supported at the extreme ends of the frame or at the center of the frame side rail or lifted at the front or rear bumper with anything other than the bumper jack provided with the car.

SERVICE INFORMATION

Complete instructions for lubrication of the various points of the 1969 Cadillac car are described in this section. An Engine Oil Change Interval and Viscosity Chart, and a Fluid Capacity Chart appear at the end of this section, on pages 0-18 and 0-19.

The Maintenance Schedule, Page 0-17 and 0-18 is based upon service at time of engine oil change, unless otherwise specified. The recommended engine oil change interval, regardless of season, is every 4 months, never to exceed 6,000 miles.

More frequent changes are required with stop and go operation, prolonged idling periods, dusty road travel, or during extended cold or wet climatic conditions. In such cases, an oil change is recommended after 2,000 or even 1,000 miles of driving.

The various points on the chassis that require a lubricant are listed in the Maintenance Schedule, Page 0-17 and 0-18. Maintenance should be performed according to the intervals specified on the Schedule. Use factory recommended fluids in the quantities specified.

1. Front Suspension

Spherical joints are used on the front suspension system at the outer ends of the upper and lower control arms, and at the inner and outer steering linkage tie rod pivots.

The front suspension spherical joints should not need repacking throughout their entire service life under normal driving conditions. At the time of an engine oil change, visually inspect all joint seals for any indication of damage, such as cuts, tears, ruptures, worn spots, etc. If a damaged seal is evident, the seal must be replaced and the joint repacked.

Special front suspension lubricant is provided in one pound cans and is available from Parts Warehouses. The repacking gun used with the lubricant has a red band around the bottom of the body cylinder.

The procedure for replacing and repacking the upper and lower suspension arm spherical joint seals is described in Section 3, Notes 25 and 28 for the 693 and Notes 7 through 10 for all other cars.

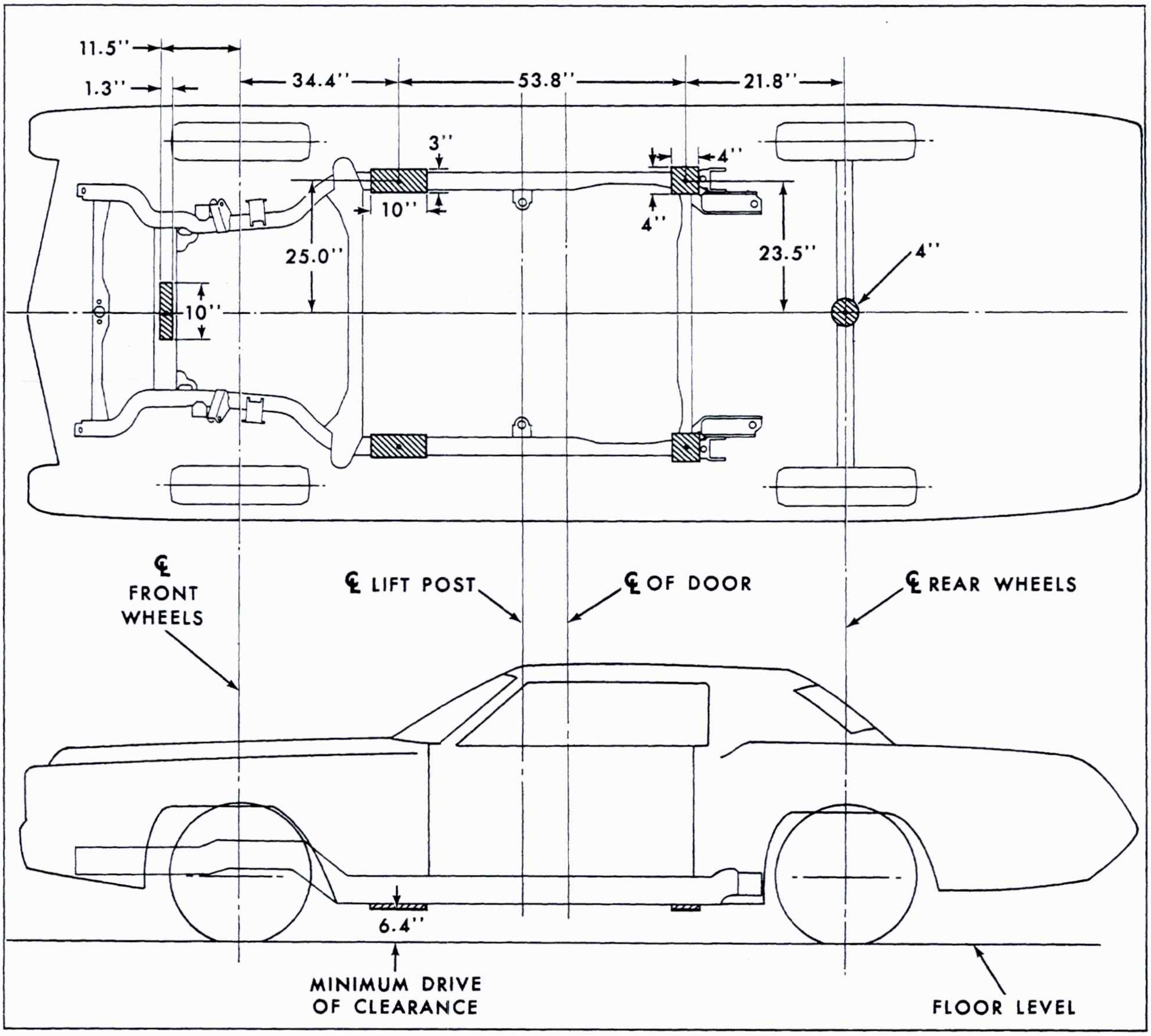


Fig. 0-7 Hoist Position - 693

Extended life spherical joints are used at both inner and outer tie rod pivots. The only maintenance normally required is to inspect the seals for physical damage each time the engine oil is changed. If periodic inspection reveals a damaged seal, the seal may be replaced and the joint repacked as described in Section 3, Note 17. If a loose joint is found, replace the joint as described in Section 9, Notes 16 and 29.

2. Engine

a. Engine Oil Recommendations

The original factory fill oil will perform satisfactorily during the normal change interval specified on the Engine Oil Change Interval and Viscosity Chart, Page 0-18, because this oil meets General Motors Standard GM 6041-M. The same chart should also be consulted for factory recommendations if additional oil should be necessary prior to the normal change interval.

The use of proper engine oil is the best assurance of continued reliability and performance from a Cadillac engine. Cadillac does not recommend oils by brand name, as assurance of oil quality is the responsibility of the refiner. Instead, the factory recommends oils that, according to their labels, are (1) intended for service "MS", and (2) represented as passing car makers' tests or General Motors Standard GM 6041-M. Cadillac Servicemen should assist owners in the selction of the proper oil that meets the above requirements, as well as the proper viscosity number for a particular area and season.

In areas where the temperature seldom drops below zero, most 10W or 10W-30 oils are satisfactory for easy starting of the engine. When the

temperature is frequently near or below zero, a 5W or5W-20 oil is recommended.

b. Adding Engine Oil (Fig. 0-8)

Always maintain the correct oil level. Oil should be added only when the level reaches the "Add One Quart" mark on the dipstick. Do not fill above the "Full" mark or foaming may result. For an accurate check of oil level wait 10 to 15 minutes after shutting off engine to allow time for oil to drain back into pan. Always check engine oil level when engine is hot.

Engine oil is added by removing the oil filler cap on the right rocker arm cover, Fig. 0-8.

Do NOT add oil if oil level is above the "Add 1 Qt" line.

c. Changing Engine Oil

The crankcase should be drained only after the engine has been warmed to normal operating temperature. The benefits of draining are minimized if the crankcase is drained when the engine is cold, as some suspended foreign matter will cling to the internal engine parts and will not drain with the slower moving colder oil.

The Engine Oil Change Interval and Viscosity Chart, Page 0-18. will serve as a guide for the proper oil change interval and oil viscosity to be used at the prevailing temperature. It is unnecessary to change the oil for the occasional unseasonably cold or warm day encountered during the fall or spring season.

The crankcase capacity is 4 quarts (5 quarts on Eldorado). Do not add more than 4 quarts except when changing oil filter in which case 5 quarts should be used (6 quarts on Eldorado).

The dipstick locations for the Fleetwood Eldorado are shown in Fig. 0-9.

3. Engine Accessories

a. Distributor

The 1969 Cadillac distributor is permanently lubricated and requires no periodic oiling. However, in the event the distributor is disassembled and the shaft or breaker plate is removed, the wick in the oil reservoir should be moistened with light weight engine oil.

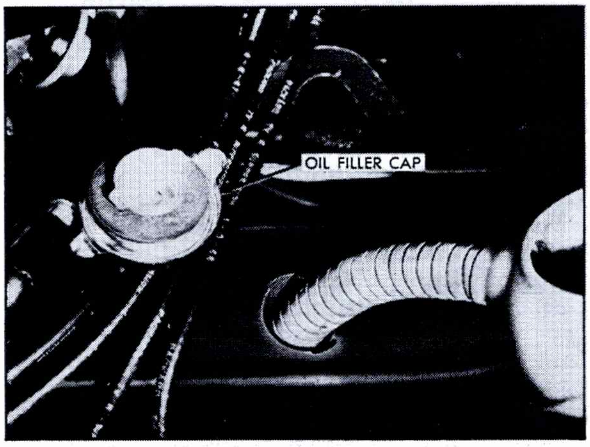


Fig. 0-8 Adding Engine Oil

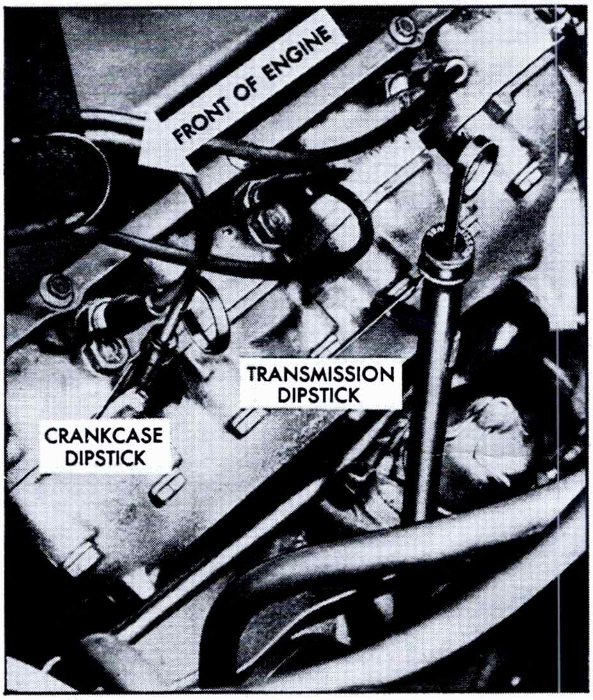


Fig. 0-9 Dipstick Locations - 693

Whenever contact point sets are changed, the distributor cam should be lubricated with a small amount of special distributor cam lubricant available from the servicing Parts Distribution Center.

b. Carburetor Air Cleaner

The carburetor air cleaner, Fig. 0-10, used on the engines of all 1969 Cadillac cars incorporate a replaceable paper element. A new air cleaner element should be installed every 24,000 miles. More frequent replacement of the element may be necessary if the car is constantly driven in dusty areas. A visual inspection of the element is recommended every spring and fall to make

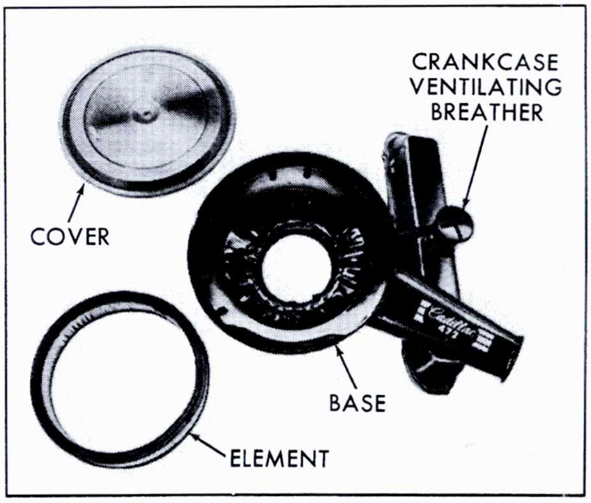


Fig. 0-10 Air Cleaner Assembly

certain that it is properly seated and that there is no indication of dust leakage. If damage is indicated at time of visual inspection, the element should be changed. To replace element, proceed as follows:

1. Remove air cleaner to air compressor hose on cars with Automatic Level Control.
2. Remove cover from carburetor air cleaner.
3. Remove element and discard.
4. Wipe all dirt from inside air cleaner cover.
5. Install a new element on air cleaner base, making certain that it is properly seated, and replace air cleaner cover and A.L.C. hose.

c. Engine Oil Filter (Fig. 0-11)

The engine oil filter used on 1969 Cadillac cars is of the spin-on, full-flow type. It is recommended that the filter be replaced at time of first engine oil change and every second oil change thereafter.

The full-flow type oil filter filters 100% of the oil delivered by the oil pump. For this reason, it is very important that the recommended oil filter change intervals be followed.

The oil filter is mounted on the front right side of the engine, Fig. 0-11. Access to the filter is gained from under the car. Replacement procedure is as follows:

1. Position car on hoist and move rubber splash shield out of the way.
2. Unscrew filter from base and discard.
3. Wipe gasket area of base clean.
4. Place a light film of silicone on top of gasket and screw filter on stud of filter base by hand until gasket touches filter base. Then tighten element an additional 2/3 of a turn.
5. Add 1 quart of oil to engine crankcase.

Fig. 0-11 Engine Oil Filter

NOTE: If engine oil is changed in conjunction with oil filter replacement, add a total of 5 quarts of oil to engine crankcase (6 on Eldorado).

6. Operate engine at fast idle and check for oil leaks at filter base.
7. After engine has run for 3 to 4 minutes, stop engine and check oil level.

4. Battery

The battery electrolyte level should be checked at every engine oil change. In warm weather, a check should be made at two-week intervals. An electrolyte level indicator vent cap is located in the second cell cap from the positive battery post. With the use of this vent cap, it is not necessary to remove cell vent caps when checking fluid level. A dark (black) spot in the center of this vent cap is visible when electrolyte is at the normal level.

If at any time the electrolyte level drops below normal, the spot changes from black to an off-white color. When an off-white condition is encountered, all cell fluids must be adjusted to their correct level. This is accomplished by adding colorless, odorless drinking water to raise the fluid level to the bottom of the slot in each vent well.

CAUTION: Do not overfill battery or add any substance to fluid except colorless, odorless drinking water.

Keep battery, cable clamps and hold-down bracket clean. If necessary, clean with a solution of ammonia and water, or baking soda and water. Flush off with water and apply petroleum jelly to cable clamps and terminals to retard corrosion.

5. Emission Control Systems

a. Air Injection Reactor

The Air Injection Reactor provided on all 1969

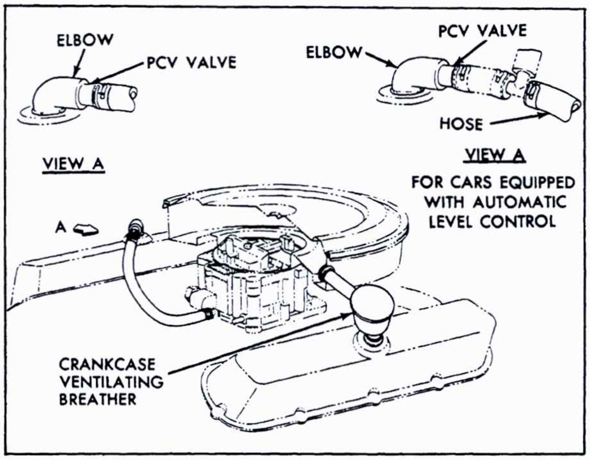


Fig. 0-12 Crankcase Ventilation System

cars is a system for exhaust emission control whereby the combustion process is continued in the exhaust manifold reducing the hydrocarbons and carbon monoxide emitted to the atmosphere.

b. Positive Crankcase Ventilation (Fig. 0-12)

The positive crankcase ventilator valve installed on all 1969 Cadillac vehicles should be replaced every 12,000 miles, or 12 months, whichever occurs first.

NOTE: Cleaning of the Crankcase Ventilating Breather is important in order to provide proper crankcase breathing. The breather is located on the left rocker arm cover. The filtering material in the unit must be cleaned with solvent at every oil filter change. Do NOT oil the filtering material.

c. Emission Control Check

A check of the itmes affecting vehicle emission control at the first oil change (4 months or 6,000 miles, whichever comes first) is important to control hydrocarbon and carbon monoxide emissions within levels established by government standards and thus reduce air pollution. This check involves adjustment of the carburetor idle speed and fuel mixture (Section 6, Note 91), engine timing (Section 6, Note 62) and an operational check of the positive crankcase ventilation valve and related parts (page 6-76).

These checks are recommended in conjunction with an engine tune-up each 12 months or at 12,000 mile intervals.

6. Power Steering

The steering gear is lubricated by the power steering fluid and requires no other lubricant. The fluid level in the pump reservoir, Fig. 0-13, should be checked every spring and fall after the engine is warm, and the reservoir kept filled with Cadillac recommended fluid. If the dipstick indicates that the fluid level is extremely low, the unit should be inspected for leaks and corrected immediately. When adding less than one pint of fluid, automatic transmission fluid may be used. When adding larger quantities or when making a complete fluid change, always use special power steering fluid. Refer to Section 9, Note 1, for checking fluid level.

7. Power Brakes

The brake fluid level of both sections of the master cylinder, Fig. 0-14, should be checked at every engine oil change and every time the power brakes are serviced. The reservoir cover incorporates a diaphragm that provides a seal between the reservoir fluid and the atmosphere to prevent moisture absorption or dust contamination.

If either the front or rear brake reservoir is found to be low, the related hydraulic system should be checked for leaks. Then fill the reservoir with SAE Delco Supreme 11 Super Heavy Duty Brake Fluid, or equivalent fluids conforming to SAE 70-R3 specifications, to within 1/8 inch to 3/8 inch of the reservoir sealing surface.

Check the travel of the service brake pedal and the parking brake pedal at the first oil change and each spring and fall thereafter. Excessive brake pedal travel is an indication of brake system malfunction.

Service brake pedal travel should not exceed 1-3/4 inch during normal brake pedal application of approximately 30 pounds force (2" on Eldorado). The parking brake pedal should travel 1-3/4 inch to 2-3/4 inch with moderate application (50 pounds

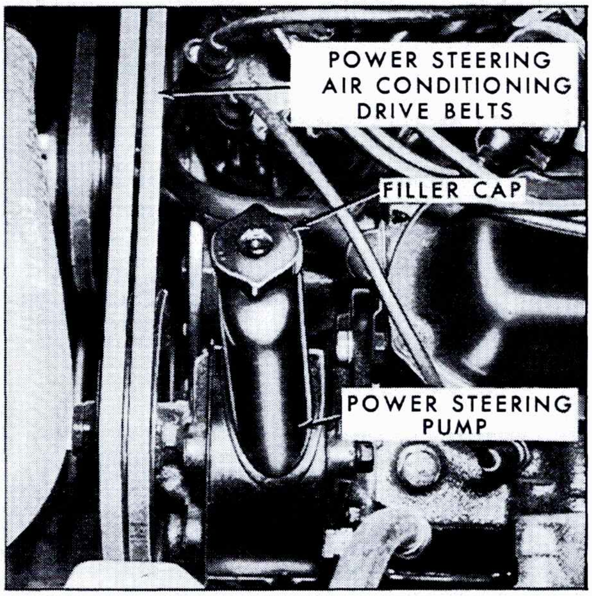


Fig. 0-13 Power Steering Reservior

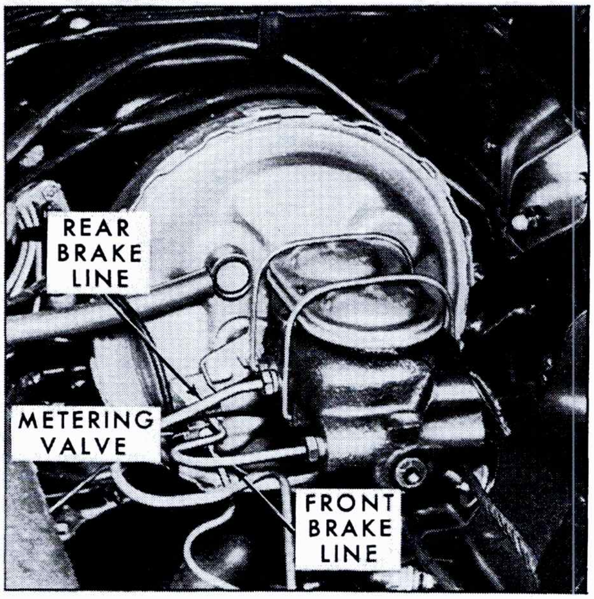


Fig. 0-14 Power Brake Reservior

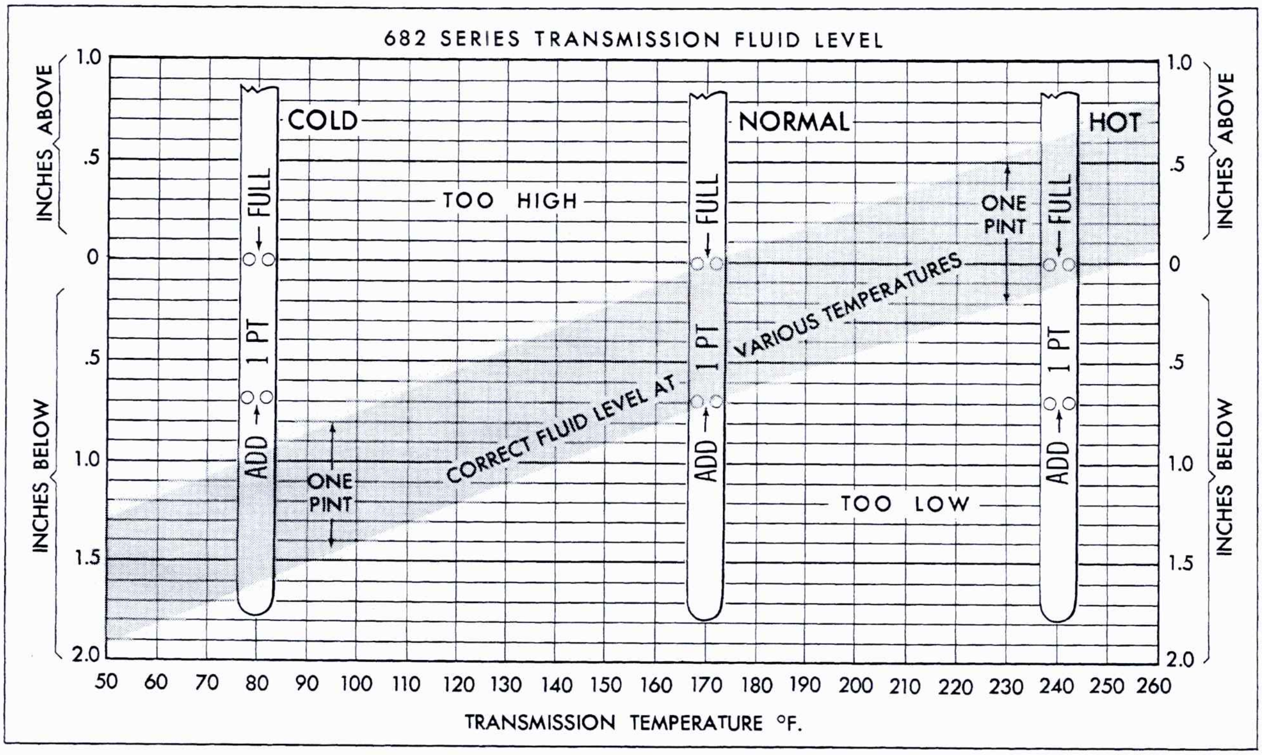


Fig. 0-15 Transmission Oil Level (Except 693)

force). If parking brake adjustment is required, lubricate parking brake links and cables.

Refer to Section 5 for adjustment procedures should either pedal travel be found incorrect.

8. Air Conditioner Compressor

The 6 cylinder compressor uses 525 viscosity oil. It is important that only the type of oil recommended by the compressor manufacturer be used. Refer to Section 1, Note 22 for lubricating recommendations.

9. Transmission

a. Fluid Recommendations

"DEXRON"® Automatic Transmission Fluid is recommended exclusively for use in Cadillac automatic transmissions. It should always be used both for adding and refilling. "DEXRON" fluid incorporates additives not used in regular fluid -- additives that are essential for satisfactory transmission performance. "DEXRON"® type fluid is distributed by General Motors and by other oil marketers.

b. Checking Fluid Level

The transmission dipstick and filler tube is located on the right side of the engine (left side on the Fleetwood Eldorado, Fig. 0.9).

Fluid level should be checked at every engine oil change. Add fluid, if necessary, until proper level is indicated on dipstick. Proper fluid level is based on operating temperature. See Figs. 0-15 and 0-16. At normal operating temperature, 1 pint of fluid will change the level from the low mark to the full mark on the dipstick.

When checking fluid level, first run engine at 800 rpm with shift lever in Park "P" position for 1-1/2 minutes to make certain converter is full. Reduce engine speed to slow idle, remove and wipe dipstick, then check fluid level. With the engine still running, add fluid through dipstick tube to bring fluid to proper level.

CAUTION: Do not overfill, as foaming may occur when fluid heats up. If fluid level is too low, especially when cold, complete loss of drive may result after quick stops. Extremely low fluid levels will result in damage to the transmission.

c. Transmission Fluid Change

1. Remove dipstick from filler tube and insert a length of hose secured to a suction gun down the filler tube. Remove enough transmission fluid so that bottom pan will not overflow when removed.
2. Raise car and remove bottom pan and empty fluid from bottom pan.
3. Install bottom pan using a new gasket.
4. Lower car and add 2 quarts of transmission fluid through filler tube.
5. Operate engine at 800 rpm for approximately 1-1/2 minutes with selector lever in park "P" position.

6. Reduce engine speed to slow idle and check fluid level. Add fluid, if necessary, to bring to proper level, Fig. 0-15 or 0-16.

d. Oil Strainer

The oil intake system incorporates an oil strainer in the transmission oil sump. The intake pipe and strainer assembly must be replaced after the first two years or 24,000 miles only, or after a major transmission failure. The procedure for removing and installing the oil strainer is described in Section 7, Note 7c.

The transmission bottom pan and strainer should be drained every 24,000 miles or two years, whichever occurs first, and fresh fluid added to obtain the proper level on the dipstick. For cars subjected to heavy city driving, or in commercial use where the engine is regularly idled for prolonged periods, the bottom pan should be drained every 12,000 miles.

To drain bottom pan, remove dipstick from filler tube and insert a length of hose secured to a suction gun down the filler tube. Remove enough transmission fluid so that bottom pan will not overflow when removed.

10. Front Wheel Bearings (Except 693) Rear Wheel Bearings (693 Only)

The wheel bearings on all 1969 Cadillac cars require repacking and adjusting when the brake linings or pads are replaced. When repacking these bearings, use a #2 grade lithium high melting point wheel bearing grease free from any fillers or abrasives. Refer to Section 10, Note 6 for repacking procedure.

11. Differential (Except 693)

Check the lubricant level in the differential only on the first inspection and add lubricant if necessary. The differential lubricant level should be within 1/2 inch of the lower edge of the filler hole. Each spring and fall, inspect differential assembly for external signs of leakage and check lubricant level only if leakage is evident.

Either SAE 90 multi-purpose type gear lubricant conforming to MIL-L-2105-B specifications or the special lubricant provided for this purpose by the Parts Department can be used for cars equipped with the standard differential. Cars equipped with the Controlled Differential should use only the special lubricant provided by the Cadillac Parts Department to assure the satisfactory operation of this unit.

When removing the filler plug, take extreme care not to allow any dirt to enter the filler hole.

Draining and refilling of the differential is necessary only at time of replacement.

12. Final Drive (693 Only)

Check the lubricant level in the final drive only at the first inspection and add lubricant if necessary. The final drive lubricant level should be within 1/2 inch of the lower edge of the filler hole. Each spring and fall, inspect the final drive assembly for signs of external leakage at the output shaft seals and at the pan gasket, and check lubricant level only if leakage is evident.

The factory recommended fluid for the final drive assembly is SAE 90 multi-purpose type

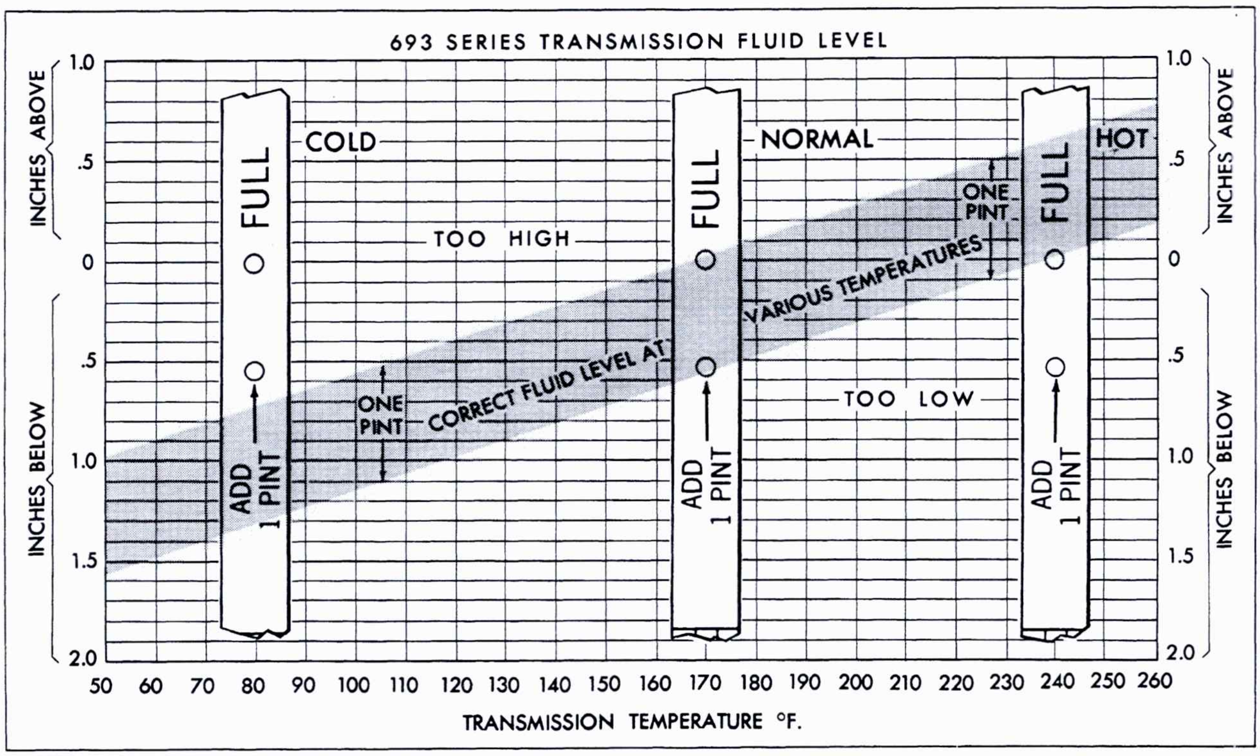


Fig. 0-16 Transmission Oil Level - 693 Only

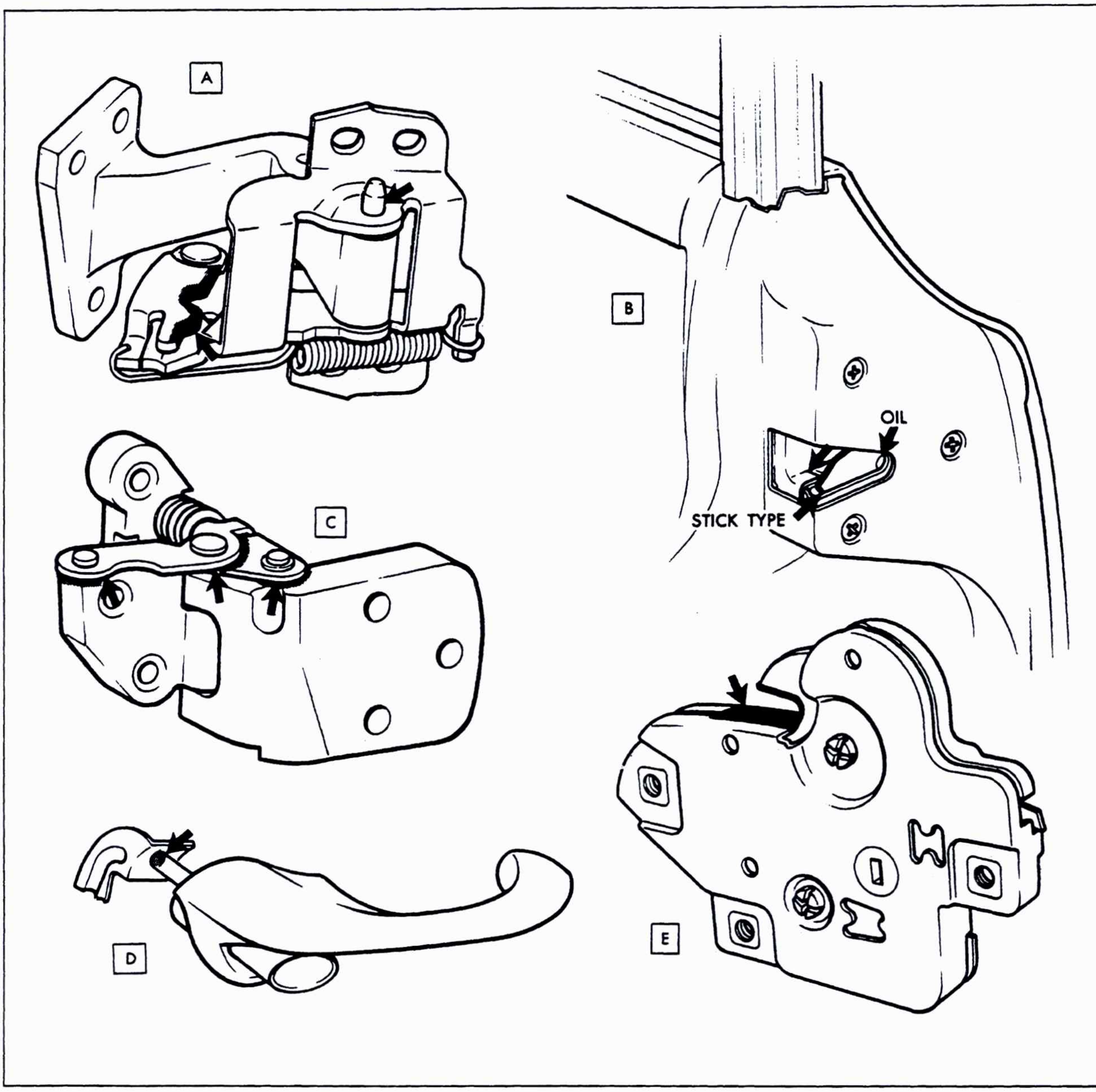


Fig. 0-17 Body Lubrication Points

gear lubricant conforming to MIL-L-2105-B specifications.

When removing the filler plug, take extreme care not to allow any dirt to enter the filler hole.

Draining and refilling of the final drive is necessary only at time of replacement.

13. Propeller Shaft (Except 693)

The 1969 propeller shaft does not require maintenance on a regularly scheduled basis, nor can it be disassembled. However, whenever the shaft is disconnected at the transmission, lubricate the outside diameter of the front propeller shaft yoke with Automatic Transmission Fluid, and the inside diameter with synthetic oil seal lubricant as outlined in Section 4, Note .

14. Body Lubrication Points

The moveable mechanical parts of the body are lubricated during production to insure proper and quiet operation. If additional lubrication is required, lubricants should be used at the locations listed, and in the manner indicated.

Each lubrication point shown in Fig. 0-17 is designated by a letter that corresponds with a letter in the note headings below.

While the pictures in Figs. 0-17, 0-18 and 0-19 represent parts of the standard car, the corresponding places of the Eldorado should also be lubricated as outlined below.

NOTE: The Lubriplate referred to in this section is Lubriplate No. 630 AAW, a grade 3

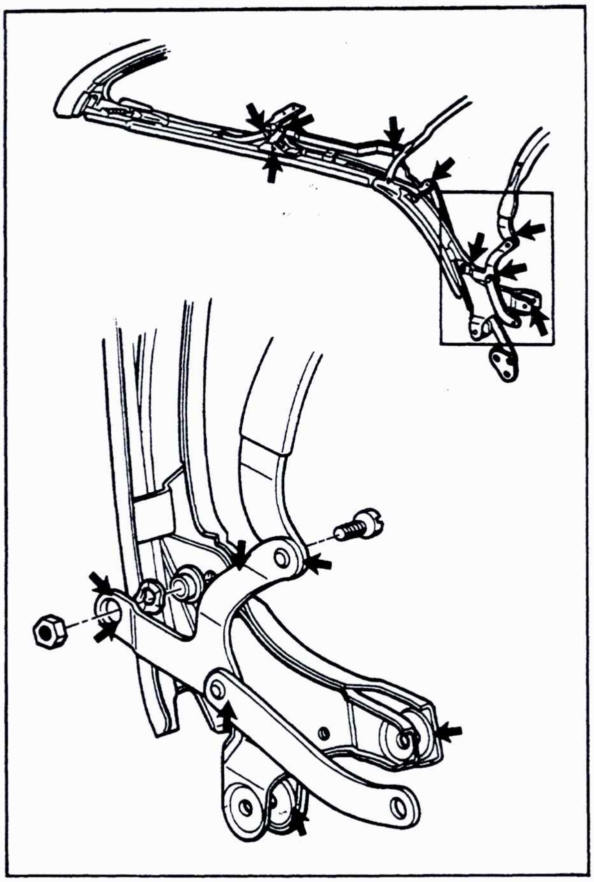


Fig. 0-18 Folding Top Linkage

zinc oxide grease. It is recommended that this type lubricant or its equivalent be used.

a. Front Door Hinge Hold-Open Assembly

Wipe off dirt and apply a light coat of Lubriplate (or equivalent) at lower arrow in Fig. 0-17. In addition, the hinge pins should be lubricated with engine oil.

b. Door Lock Fork Bolt

Wipe off dirt and apply a thin coat of stick-type lubricant and oil at points indicated.

c. Rear Door Hinge and Hold-Open Assembly

Wipe off dirt and apply a light coat of Lubriplate to frictional points indicated. Wipe off excess lubricant.

d. Door Lock Outside Handle

Apply a light coat of Lubriplate to surface of lock cylinder shaft contacting bell crank.

e. Rear Compartment Lid Lock

On rear compartment lid lock apply a thin film of Lubriplate at point indicated.

Front Door Torsion Rods (693 Only)

Apply a thin coat of Lubriplate at all friction points of torsion rods.

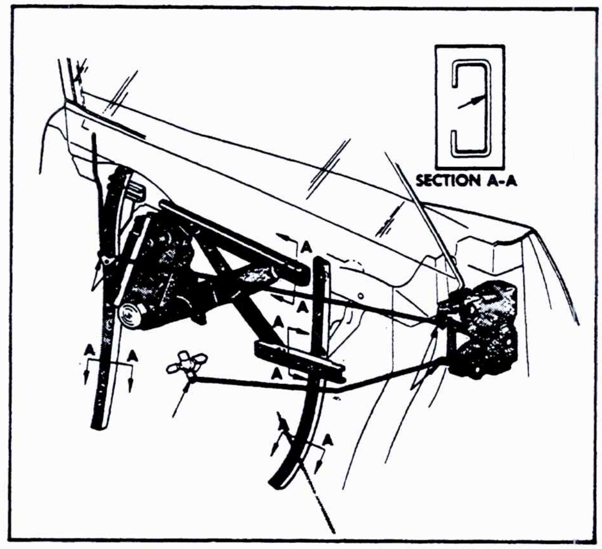


Fig. 0-19 Window Linkage

Rear Compartment Lid Hinges and Torque Rods

Apply Lubriplate to hinge and torque rods at friction points.

Hood Latch Mechanisms

Apply a small amount of lubricant to the striking surface, and apply light oil to the moving joints of all hood primary and secondary latch mechanisms and hinges each spring and fall.

Hood Hinges

Apply a few drops of light oil to all the moving joints of the hood hinges each spring and fall.

Gasoline Tank Filler Door Hinges

Apply a light coat of zinc oxide grease to all moving joints of the gasoline tank filler door hinges each spring and fall.

Transmission Linkage

Lubriplate all transmission linkage friction points each spring and fall with a grade 3 zinc oxide grease (except Eldorado). Lubricate Eldorado linkage with a grade 2 lithium soap grease.

Front Seat Adjuster Mechanism, Manually and Electrically Operated

Thoroughly wipe off old lubricant. Apply a thin coat of Lubriplate to jack screws and seat tracks. Operate seat to limits of all positions. Apply a small amount of dripless oil to linkage and wipe off excess lubricant.

Folding Top Linkage

Apply a small amount of light oil to all bearing points, Fig. 0-18. Wipe off excess lubricant to prevent soiling trim.

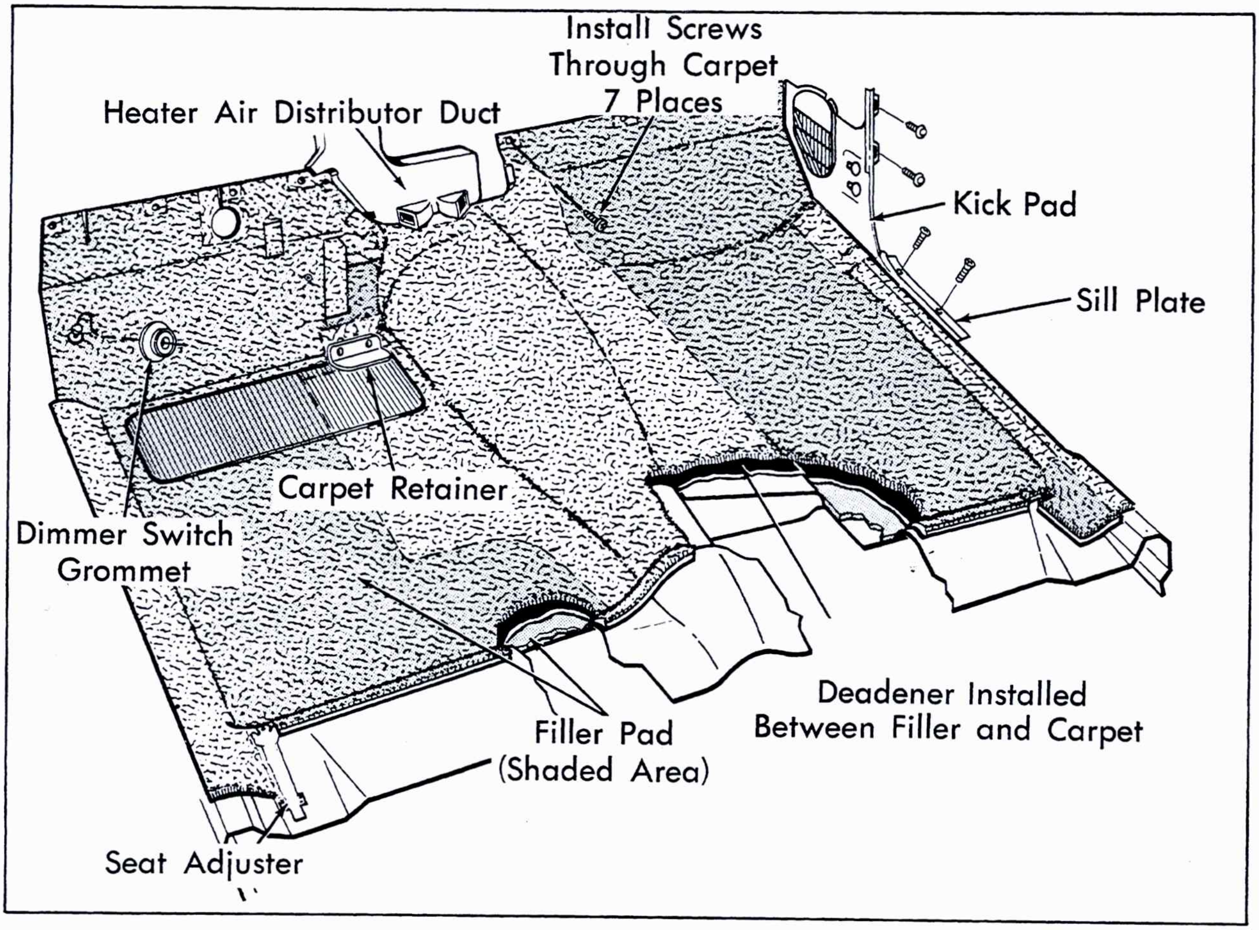


Fig. 0-20 Installing Front Carpet - Except 693

Folding Top Lift Cylinder Piston Rods

With folding top in raised position, wipe exposed portion of each top lift cylinder piston rod with a cloth dampened with transmission fluid to remove any oxidation or accumulated grime. With another clean cloth, apply a light film of transmission fluid to the piston rods to act as a lubricant.

NOTE: Use caution so that the transmission fluid does not come in contact with any painted or trimmed parts of the body.

Window Regulators, Cams and Guides

Apply a coat of Lubriplate to regulator teeth, cams and guide channels as required. Fig. 0-19 is typical of front and rear door windows and rear quarter windows.

15. Points Requiring No Lubrication

No lubrication is required at the generator, water pump, propeller shaft bearings, or rear wheel bearings (except 693), as all of these bearings are packed with sufficient lubricant at time of assembly.

In addition to the above, lubrication is not required at any of the following locations:

a. Front upper and lower suspension arm pivot points.

b. Pitman arm or idler arm pivots.

c. Manifold heat control valve.

d. Front and rear pivot points of rear upper and lower control links.

e. Rear springs, shackles, or spring liners on Commercial Chassis and Eldorado.

f. Tie rod linkage.

g. Starter motor.

h. Speedometer cable.

16. Installing Front Carpet

Remove front floor pan insulation material, rubber mat, carpet, and kick-pads from trunk compartment, and proceed as follows:

1. Remove accelerator pedal-to-carpet retainer, dimmer switch grommet, and sill plates. On the Fleetwood Eldorado, also remove or loosen the accelerator pedal linkage sufficiently to permit carpet later to be tucked under linkage.
2. Raise steering column boot, and remove dash insulator retaining screws if present.

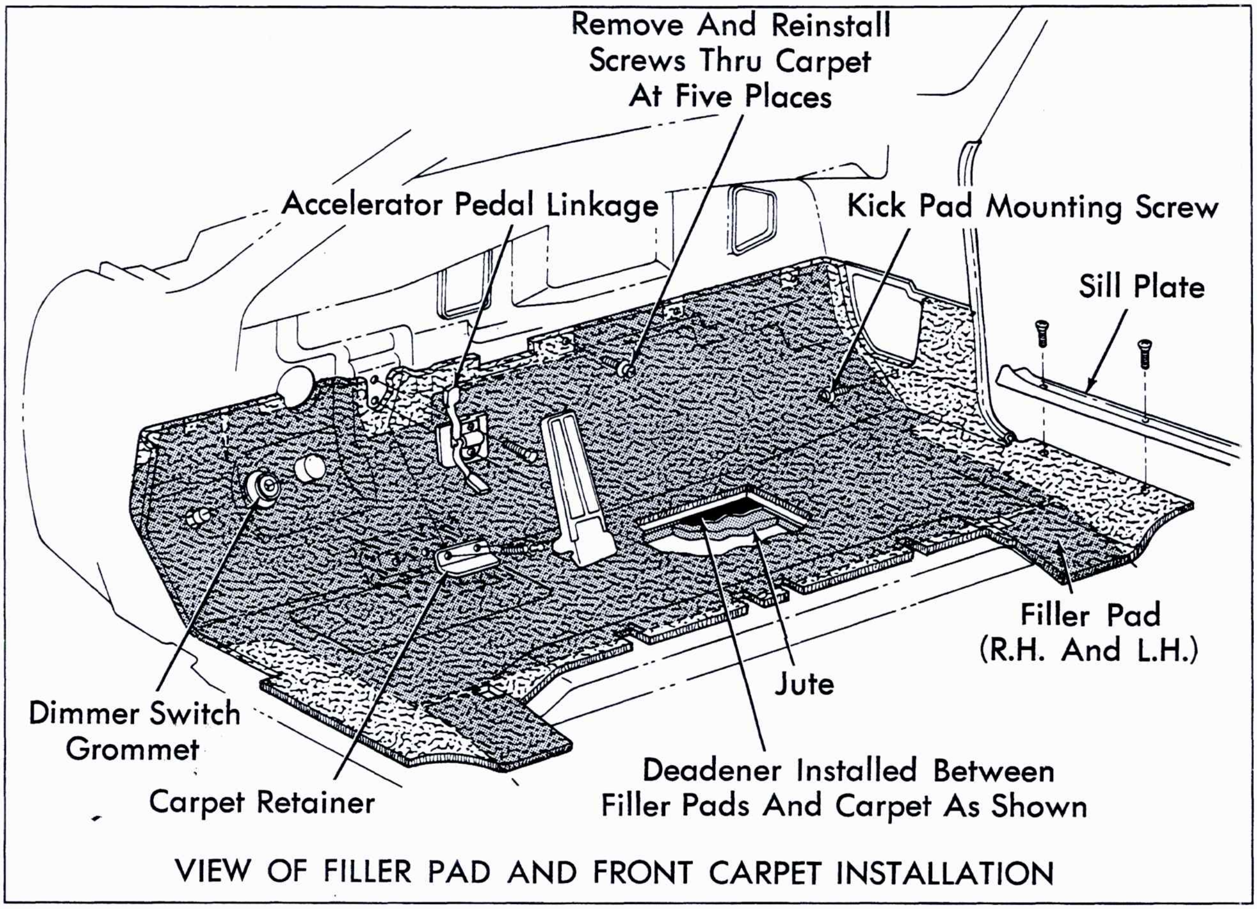


Fig. 0-21 Installing Front Carpet - 693 Only

NOTE: Screws are in trunk compartment package. Seven screws are used on all cars except the Eldorado; and five on the Fleetwood Eldorado.

3. Check for, and remove any foreign material such as loose screws, washers, protruding clips etc. Make sure wiring and vacuum hoses are not out of position on floor pan which could cause lumpy or poor fit of the carpet.
4. If car is equipped with Guide-Matic, tear out perforated section in upper left corner of carpet for clearance at relay.
5. Position filler pads to floor pan, as shown in Fig. 0-20 (all except 693), and Fig. 0-21 (693 only).
6. Position sound deadener over filler pad.
7. On all cars except 693 series, loosen screws holding kick pad in place.
8. Fold carpet with fold facing forward in-car position, and place in car. By folding carpet in this manner, carpet will be easier to handle and position once inside car.
9. Carefully position carpet at dash, accelerator pedal area, steering column, and center heater outlet. Smooth out all wrinkles as much as possible.
10. On all cars except 693 series, position carpet under kick pads.
11. Install carpet retainer; see Fig. 0-20 and 0-21. Screws must go through carpet.
12. On all cars with air conditioning, except 693 series, install clip to hold carpet away from heater opening on drivers side of heater outlet.
13. Install retaining screws at dash.
14. Tuck carpet under front seat guards.
15. Install dimmer switch grommet and accelerator pedal. Position steering column boot. On the Fleetwood Eldorado, install accelerator pedal linkage.
16. Check carpet for final positioning and smooth out any remaining wrinkles, working them toward sill plates.
17. Work left kickpad partially into place until upper end of windhose portion touches lower end of windshield garnish molding, then work windhose up inside molding (693 series only).
18. Work windhose over entire length of pinchweld flange (693 series only).
19. Position kickpad into seated position, and install windhose hinge pillar screws.
20. Secure kickpad into position with screws through shroud inner panel.
21. Install sill plate. Retaining screws must go through carpet.
22. Repeat Steps 16 through 21 for opposite side.
23. Check carburetor linkage to assure that

wide-open throttle can be achieved. Adjust if required.

24. Install console on cars so equipped and code console door lock.

PREVENTIVE MAINTENANCE

17. Periodic Preventive Maintenance Operations

a. Cooling System

Flush every 24 months with clear water and add ethylene glycol coolant and cooling system conditioner to the radiator. Refer to Section 6, Note 1 for information on the preparation of the cooling system for cold weather.

b. Fuel Filter

Replace fuel filter every spring and fall.

c. Engine Oil Filter

Replace filter at time of first oil change and every other oil change thereafter.

d. Air Conditioner

On all Air Conditioning Systems, before Summer use:

1. Clean out insects and dirt from condenser.
2. Check compressor belt tension, Section 6, Note 11.
3. Check overall performance of Air conditioner.
4. Check sight glass for full charge of refrigerant.
5. Leak test system for refrigerant and oil leaks.

For complete Air Conditioner maintenance, see Section 1, Note 9.

MAINTENANCE SERVICE AND SCHEDULE

A program of preventive maintenance has become an essential part of vehicle operation. The proper care and maintenance of a new Cadillac as set forth in the Cadillac Owner Protection Plan booklet will preserve an owner's investment, avoid expensive repairs and will ultimately result in lasting satisfaction for the Cadillac owner. When new Cadillac cars are brought in for service, the suggested inspections and maintenance services as listed in the Owner Protection Plan booklet should be performed by the Serviceman. These inspection and maintenance services are those which experience and testing have shown to be the most likely needed servies at that particular mileage or time interval for an average owner. However, driving habits, driving conditions, geographical locations and climatic conditions all influence maintenance requiremems.

In addition to these maintenance services, some components of the vehicle may require periodic maintenance depending upon usage.

The Cadillac Serviceman should also recommend additional items of maintenance based on conditions such as local weather, owner driving habits, and periodic factory service bulletins.

The maintenance schedule outlined on pages 0-18 and 0-19 will provide the Serviceman with an excellent reference for seasonal maintenance recommendations as well as regular inspections and maintenance services.

MAINTENANCE SCHEDULE

Interval	Service To Be Performed
Every 4 months, never to exceed 6,000 miles	Change engine oil. Clean crankcase ventilating breather on left rocker arm cover. Inspect front suspension and steering linkage. Check tires for damage, wear and proper inflation. Check underside of car for excess dirt, (mud, gravel, tar, etc.) paying particular attention to propeller shaft, wheels, and brake drums. Inspect exhaust system. Check brake fluid level. Check battery electrolyte level. Check transmission fluid level. Check power steering fluid level. Check coolant level in overflow reservoir. Check items affecting vehicle emission control and operation of PCV valve and related parts at first oil change only.
At first oil change and every second oil change thereafter	Change engine oil filter. Check all engine drive belts. Check all brake lines for leaks and damage. Check brake pedals (parking and service) for travel.
Every 6,000 miles	Rotate tires. Tire rotation may be required more frequently on Eldorado (4,000 miles) if car is driven under extreme operating conditions.
Every 12 months or 12,000 miles	Check brake linings for wear (every six months after the first inspection). Lubricate parking brake cables (every six months after the first inspection). Replace positive crankcase ventilation valve. Clean, inspect or replace, if necessary, crankcase ventilation system hoses, fittings and attaching parts. Engine Tune-Up. Change Fuel Filter. Tighten rocker arm cover screws.
2 years or 24,000 miles	Drain transmission bottom pan every 24,000 miles or 2 years, whichever occurs first, and add fresh fluid. (normal passenger car usage). Replace intake pipe and strainer assembly after the first 24,000 miles or 2 years only, or in any case of major transmission failure. Replace carburetor air cleaner element. More frequent replacement may be necessary if vehicle is driven in dusty areas. Clean and oil clock. Flush cooling system and refill with ethylene glycol base coolant solution. Add cooling system conditioner to the radiator.
Every spring	Check manifold heat valve. Oil accelerator linkage. Check transmission for leaks and lubricate linkage. Check and open muffler and resonator drain holes. Check differential for leaks. (All except 693) Check final drive assembly for leaks (693 only). Inspect and open body and door drain holes. Test cooling system for leaks and coolant for freeze protection. Inspect carburetor air cleaner for dust leaks. Leak test complete air conditioning system. See Section 1, Note 3. Lubricate all hood primary and secondary latch mechanisms and hinges. Oil door hinges, etc. Oil fuel filler door. Check engine for oil leaks. Check condition of radiator and heater hoses and replace as necessary. Check operation of engine temperature warning light.

Interval	Service To Be Performed
Every fall	Check manifold heat valve. Oil accelerator linkage. Check transmission for leaks and lubricate linkage. Check and open muffler and resonator drain holes. Check differential for leaks. (All except 693) Check final drive assembly for leaks (693 only). Inspect and open body and door drain holes. Test cooling system for leaks and test coolant for freeze protection. Add cooling system conditioner (after 24,000 miles). Inspect carburetor air cleaner for dust leaks. Check choke operation. Clean battery terminals and clamps. Lubricate all hood primary and secondary latch mechanisms and hinges. Oil door hinges, etc. Oil fuel filler door. Check engine for oil leaks. Check condition of radiator and heater hoses and replace as necessary. Check operation of engine and water temperature warning lights.

ENGINE OIL CHANGE INTERVAL AND VISCOSITY CHART

Prevailing Temperature	SAE Viscosity* Recommendations	Change Interval**
Above Freezing (+32°F.)	SAE-20W SAE-10W-30	Every 4 months, never to exceed 6,000 miles.
Below Freezing (+32°F. to 0°F.)	SAE-10W SAE-10W-30	
Below 0°F.	SAE-5W SAE-5W-20	

OIL VISCOSITY PRECAUTIONS

SAE 5W and 5W-20 oils are not recommended for sustained high speed driving.

SAE 30 and SAE 20W-40 oils may be used at temperatures above 90°F.

SAE 5W-30 oils may be used at temperatures below 32°F.

SAE 10W-40 oils may be used at temperatures between 0° and 90°F.

*Choice of engine oil should be restricted to those oils which, according to the label are: (1) intended for "MS" service, and (2) represented as passing car makers' tests or General Motors Standard GM 6041-M.

**If there is danger of oil contamination by dust, water, or other foreign material during very extreme driving conditions, then the engine oil should be changed more frequently than shown in the table. In such cases, an engine oil change should not exceed 2 months or 3,000 miles, whichever occurs first.

FLUID CAPACITIES

All Series Unless Otherwise Noted	U. S. Measure	Imperial Measure
Engine Crankcase		
All (Except Eldorado)	4 Quarts	3-1/4 Quarts
Eldorado Only	5 Quarts	4-1/4 Quarts
When Filter is Changed		
All (Except Eldorado)	5 Quarts	4-1/4 Quarts
Eldorado Only	6 Quarts	5 Quarts
Cooling System		
With Air Conditioning	21.8 Quarts	18-1/4 Quarts
With Heater Only	21.3 Quarts	18 Quarts
75 Series Only	24.8 Quarts	20-3/4 Quarts
Air Conditioner - Refrigerant 12	4 Pounds	4 Pounds
75 Series Only	5/-1/4 Pounds	5-1/4 Pounds
Air Conditioner Compressor Oil -		
525 Viscosity	10-1/2 Fluid Ounces	8-3/4 Ounces
75 Series Only	13-1/2 Fluid Ounces	1/4 Ounces
Rear Axle (Except 693)	5 Pints	4-1/2 Pints
Final Drive (693 Only)	4-1/2 Pints	3-1/4 Pints
Gasoline Tank (All std. series)	26 Gallons (Approx.)	21-3/4 Gallons (Approx.)
Commercial Chassis	20 Gallons (Approx.)	16-3/4 Gallons (Approx.)
Fleetwood Eldorado	24 Gallons (Approx.)	20 Gallons (Approx.)
Turbo-Hydra-matic Transmission (Except 693)		
Dry	12 Quarts, 1 Pint	10 Quarts
Pan and Strainer Removed	8 Pints, 3 Ounces	6 3/4 Pints
Turbo Hydra-matic Transmission (693 Only)		
Dry	13 Quarts, 1 Pint	10-3/4 Quarts
Pan and Strainer Removed	11 Pints, 9 Ounces	9-1/2 Pints

FACTORY RECOMMENDED FLUIDS

Unit	Fluid Recommendations
Engine oil	Oils which are according to the label (1) intended for "MS" service, and (2) represented as passing car maker's tests or General Motors standard GM 6041-M.
Transmission	"Dexron" ® Automatic Transmission Fluid.
Brake System	SAE Delco Supreme 11 Super Heavy Duty Brake Fluid or brake fluids conforming to SAE 70-R3 Specifications.
Differential (Except 693)	SAE 90 "Multi-Purpose" lubricant conforming to MIL-L-2105-B specifications (Standard Differential Only).
Controlled differential	Special rear axle lubricant available from servicing Parts Warehouse (standard or Controlled Differential).
Final Drive (693 only)	SAE 90 "Multi-Purpose" lubricant conforming to MIL-L-2105-B specifications.
Power Steering System	Cadillac power steering fluid available from servicing Parts Warehouse.
Propeller Shaft Front Slip Yoke (Fleetwood Seventy-Five Sedans and Limousines and Commercial Chassis)	Transmission Fluid.
Propeller Shaft Slip Yoke (680, 681, 682, 683)	Outside Diameter with Transmission Fluid. Inside Diameter with Synthetic Oil Seal Lubricant.
Convertible Top Hydraulic System	Transmission Fluid.
Battery	Colorless, odorless, drinking water.
Radiator	Ethylene Glycol Base, Anti-Freeze Coolant.
Engine Fuel	"Premium" Grade Motor Fuel.
Air Conditioning System Lubricant	525 Viscosity Refrigeration Oil. Refer to Section 1, Note 22.
Refrigerant	Refrigerant "12".

TABLE OF CONTENTS

GENERAL DESCRIPTION
SERIES 680-1-2-3 AIR CONDITIONER

Air conditioning is standard equipment on the Fleetwood Seventy-Five Sedans and Limousines and optional on all other series cars. The first part of this section contains descriptive material and service information for the series 680-1-2-3 air conditioner system, and for the limousine front system, which is almost identical to the series 680-1-2-3 system. Information on the series 680-1-2-3 standard heater (no air conditioning), the Limousine rear air conditioner, and the Eldorado air conditioner and standard heater is contained in the last part of this section - see table of contents.

The location of most of the air conditioner components is shown in Fig. 1-1 and 1-2. The description that follows will cover the air delivery system, the refrigeration system and the automatic temperature control system.

AIR DELIVERY SYSTEM

In normal operation air utilized by the system

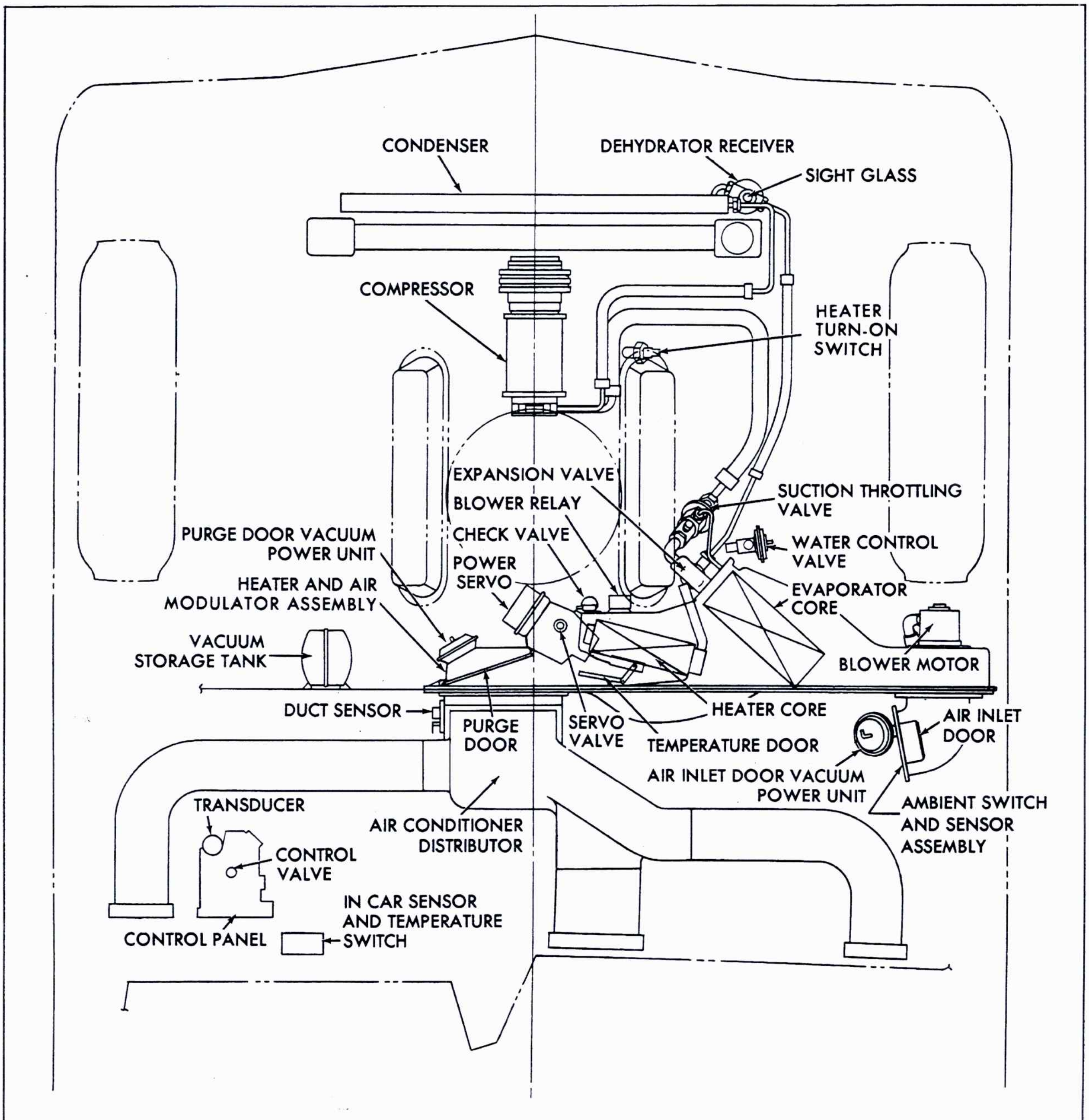


Fig. 1-1 Location of Air Conditioner Components

is drawn into the system through the plenum opening at the base of the windshield. All of this air is directed through the evaporator, where it is filtered, dehumidified and cooled to approximately 32°F. It is then "reheated" as required by being passed through and around the heater core. It then flows into a "mode selector" housing containing air doors that direct it to the air conditioner outlets in the instrument panel, to the heater distributor at floor level or to the defroster outlets. The components comprising the air delivery system are described below.

a. Air Inlet

The air inlet, located in the RH side of the shroud, is composed of a housing, an air door and a vacuum actuator that controls the position of the door. A flexible air hose connects the air inlet to the blower. The vacuum actuator is a single-stage unit. The door has only two positions. With no vacuum applied to the actuator, the door permits only outside air to be drawn into the system. When vacuum is applied to the actuator, the door moves to a position where it blocks off almost all outside air and allows approximately 80% of the total air supply to be recirculated from the passenger compartment.

b. Evaporator and Blower

The evaporator and blower, shown in Fig. 1-3, is located in the engine compartment on the right side of the cowl. This assembly consists of a plastic housing, a sirocco-type blower, the evaporator core, and two refrigerant control valves. The evaporator core, which is aluminum and similar in construction to the car radiator, is the actual cooling unit of the system. The blower draws air from the air inlet and forces it through the evaporator core, where it is cooled and dehumidified. A thin-walled rubber tube on the bottom of the housing allows condensate to drain from the housing. The blower is air-cooled; a small portion of blower output air is recirculated through the motor housing via a rubber tube.

c. Heater and Air Modulator

This assembly, shown schematically in Fig. 1-4, is located on the cowl just to the left of the evaporator and blower. It consists of a plastic housing, a heater core, a temperature door, a "purge" door, and a vacuum actuator that controls the purge door. The cold, dehumidified air from the evaporator enters this assembly and is reheated, as required, by the heater core.

The temperature door controls the amount of reheat that takes place. In one position it forces all the air from the evaporator to flow through the hot heater core - the resultant air stream is very hot. In the extreme opposite position it forces all the air to bypass around the heater

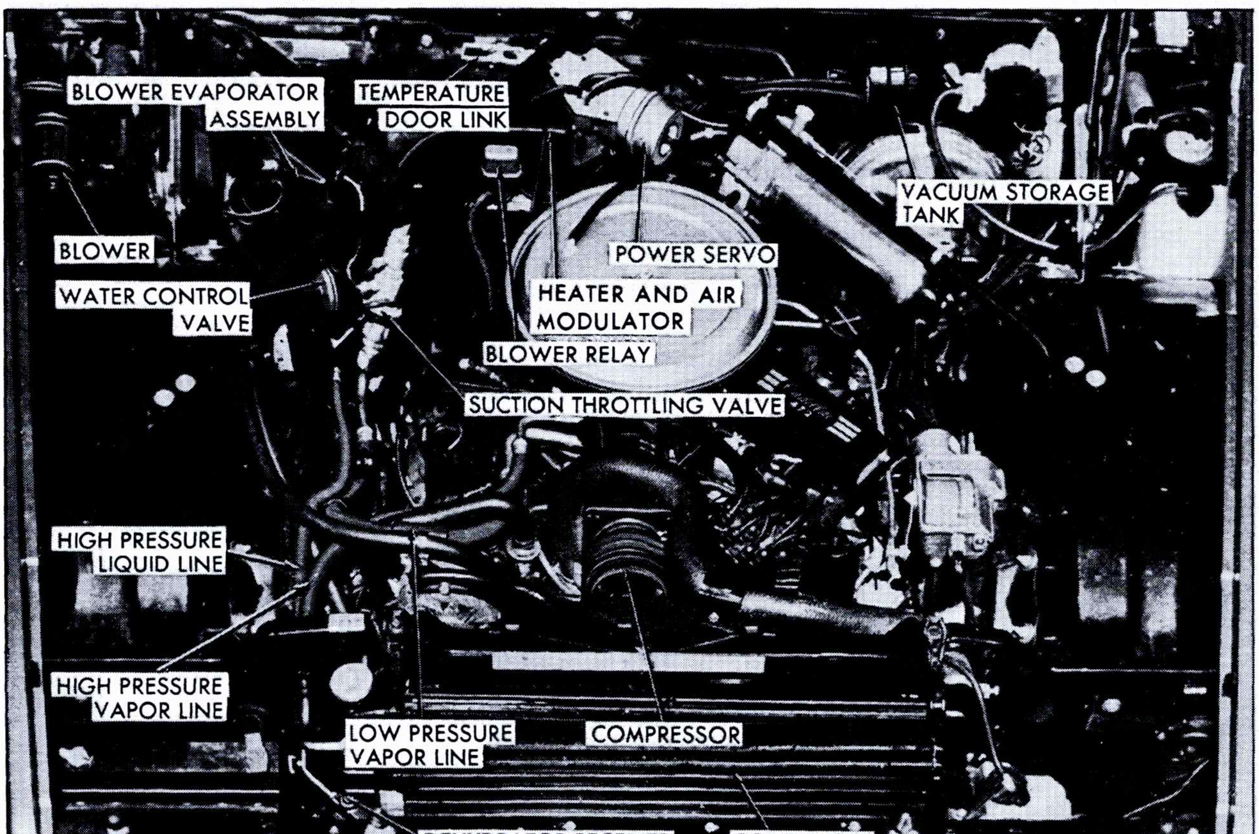


Fig. 1-2 Air Conditioner Underhood Units on Car

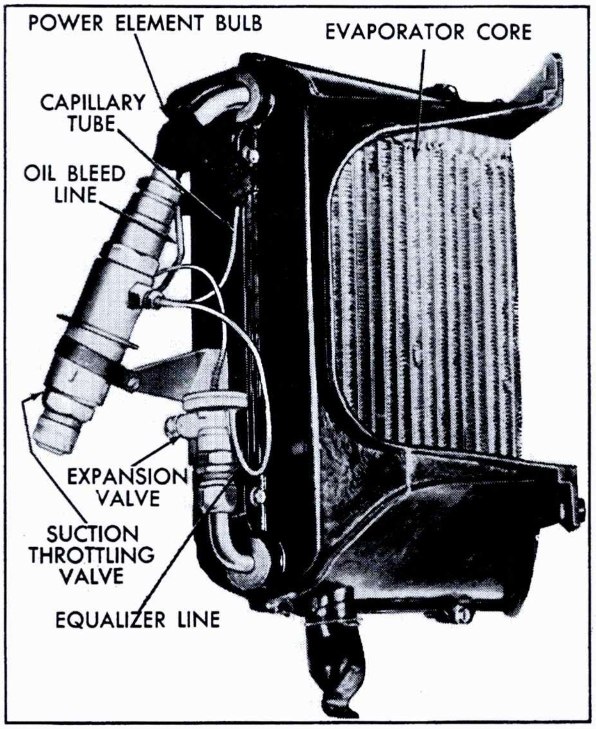


Fig. 1-3 Front Evaporator Assembly

core so that no reheat takes place and the resulting air stream is very cold. In intermediate positions, some air passes through the heater core and some bypasses it, so that the resulting airstream is mixed to the desired temperature.

The purge door, located in the LH end of this assembly, is the master air door in the air delivery system. In one position, with no vacuum to the vacuum actuator, it prevents air from entering the car, diverting it into the engine compartment through a triangular opening in the bottom surface of the heater case. The door is called a "purge" door because in this position it allows warm, humid air to be purged from the evaporator and heater cases and discharged into the engine compartment. When vacuum is applied to the purge door actuator, the door blocks off the triangular purge opening and allows all the air to flow into the car where it enters the "mode selector".

d. Mode Selector

The mode selector is located on the cowl panel in the passenger compartment at centerline of car - see side view in Fig. 1-4. This assembly selects modes of air delivery; it directs air to the air conditioner outlets, to heater outlets or to defroster outlets, in response to vacuum signals from the temperature control system. It consists of a plastic housing, a mode door, a defroster door and three vacuum actuators. The mode door has two positions; with no vacuum to its actuator, it diverts the air stream entering the mode selector toward the heater and defroster outlets; when vacuum is applied to the actuator, the door is pulled downward so that it deflects all the air upward into the air conditioner distributor.

The defroster door is located in the lower part of the mode selector. It is controlled by two small vacuum actuators and has three positions. With no vacuum applied to either actuator, it is in a full rearward position, allowing no airflow to the defroster outlets. When vacuum is applied only to the RH actuator, which is called the "defroster bleed actuator", the door is pulled forward slightly to allow a small bleed of air to the defroster outlets. When vacuum is applied to the LH actuator, the door is pulled fully forward

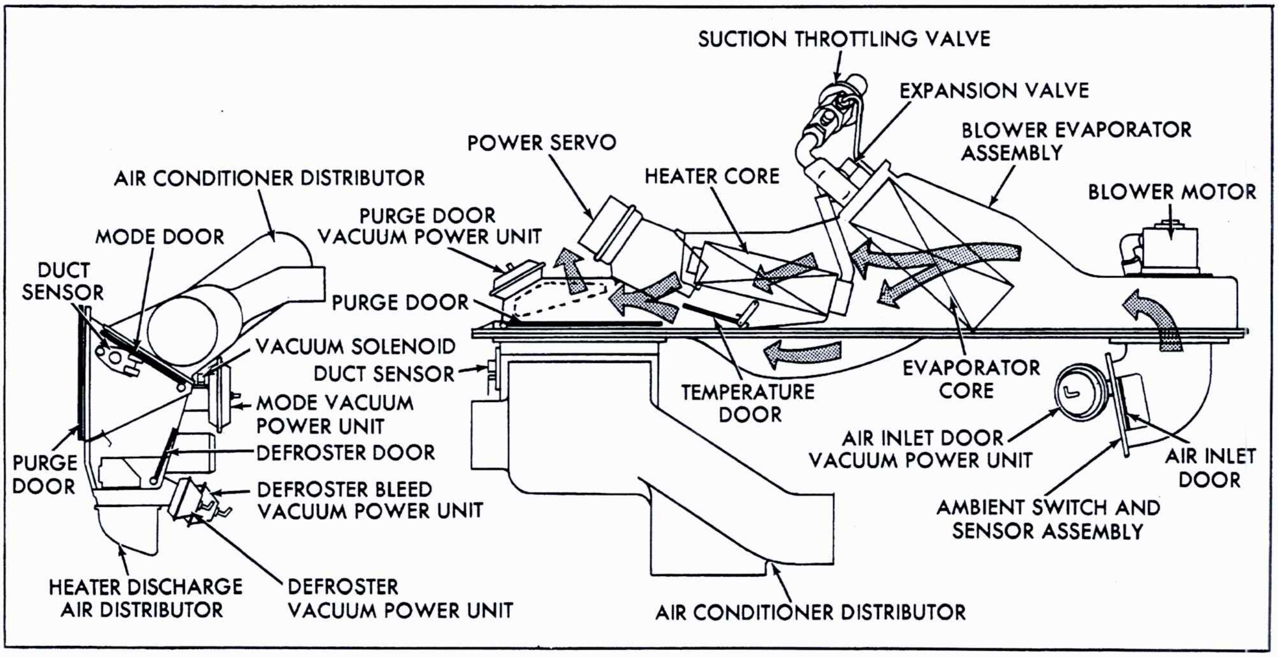


Fig. 1-4 Air Flow through Doors - Purging

where it causes almost all the air to be diverted to the defroster outlets.

e. Air Conditioner Distributor

The air conditioner distributor is a large plastic duct located on top of the mode selector. It distributes air to the LH and RH air conditioner outlets through flexible insulated air hoses, and to the center outlet through a rubber boot.

f. Air Conditioner Outlets

Three dual air conditioner outlets are located in the instrument panel. The LH outlet is located at the left side of the instrument cluster; the center and RH outlets are located in the insert area of the instrument panel cover. Each outlet provides two air streams whose direction can be controlled independently by the knobs on the outlet. The downward travel of the outboard knob on the RH outlet has been restricted to prevent air from being blown into the ashtray in the RH armrest. A moderate flow of cool air to the floor is provided by two small plastic elbows located on the sides of the mode selector near the top. These elbows can be rotated to obtain a more diffused and indirect flow of air to the floor area, if desired.

g. Heater Distributor

The heater distributor is attached to the bottom surface of the mode selector. It distributes air to the RH and LH sides of the front floor and also directs two heavy streams of air under the front seat to heat the rear compartment.

h. Defroster Outlets

Two defroster outlets are located on the cowl panel at the base of the windshield. They are connected to the mode selector by flexible air hoses.

i. Air Flow Diagrams

Air flow through the system in various situations is illustrated in Fig. 1-4 through 1-7.

Fig. 1-4 shows how air is circulated through the various components when the purge door is in its purging position. Note that air does not enter the passenger compartment but is discharged into the engine compartment. When the car is operated with the control head lever at "off" this type of airflow will occur with the blower operating at a low speed. When the system is turned on, this pre-conditioned air will then be delivered into the car. This type of purging operation also occurs when the system is being delayed for engine water warm-up in cold weather.

Fig. 1-5 shows the purge door in a position to allow air to enter the mode selector. The mode door is in its upward position (no vacuum) which diverts air downward to the heater distributor. The defroster door is shown in a bleed position (vacuum to small RH actuator) so that a small quantity of air is diverted to the defroster outlets to prevent fog formation.

Fig. 1-6 shows what happens when vacuum is applied to the LH defroster actuator. The defroster door moves downward and intercepts almost all the air that normally flows to the heater distributor.

Fig. 1-7 shows the purge door actuated to allow pre-conditioned air to enter the car and the mode door in its downward position (vacuum applied to actuator). Air is then routed to the air conditioner outlets.

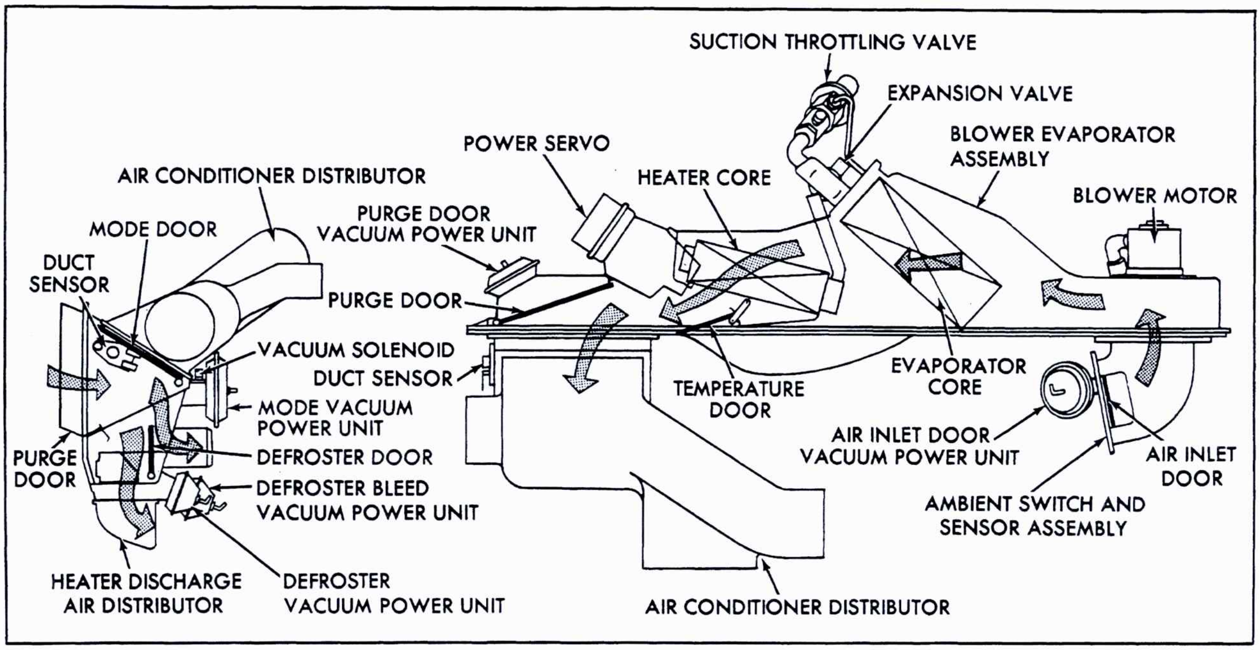


Fig. 1-5 Air Flow through Doors - Maximum Heating

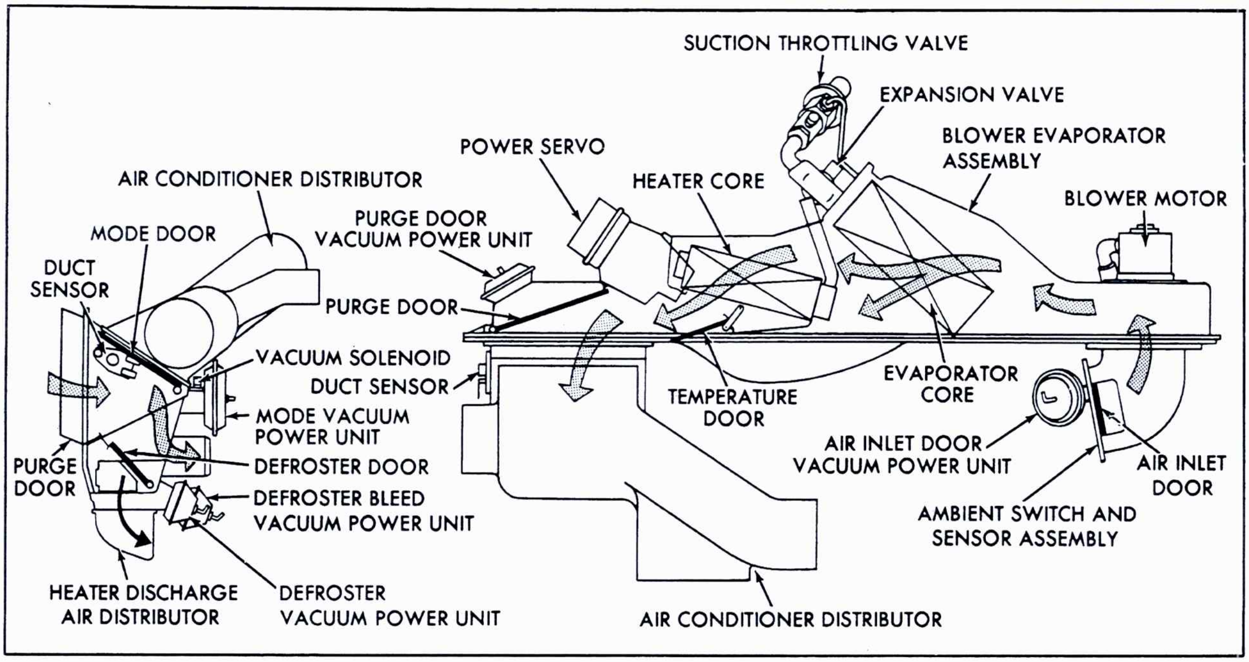


Fig. 1-6 Air Flow through Doors - Fog and Ice

REFRIGERATION SYSTEM

The sole function of the refrigeration system is to maintain the evaporator core at approximately 32° when refrigeration is required. Six major components, interconnected by rubber hose and metal tubing, accomplish this - the compressor, the condenser, the receiver-dehydrator, the expansion valve, the evaporator core, and the suction throttling valve. Location of these parts is shown in Fig. 1-1 and Fig. 1-2. A brief description of each component and an explanation of the refrigeration circuit follow.

a. Compressor

The compressor is located on top of the engine near centerline and is driven by two belts from the crankshaft pulley. Its function is to pump refrigerant around the refrigeration circuit and to provide pressure and temperature levels at which heat exchange can take place. It utilizes three double-acting pistons positioned axially around the

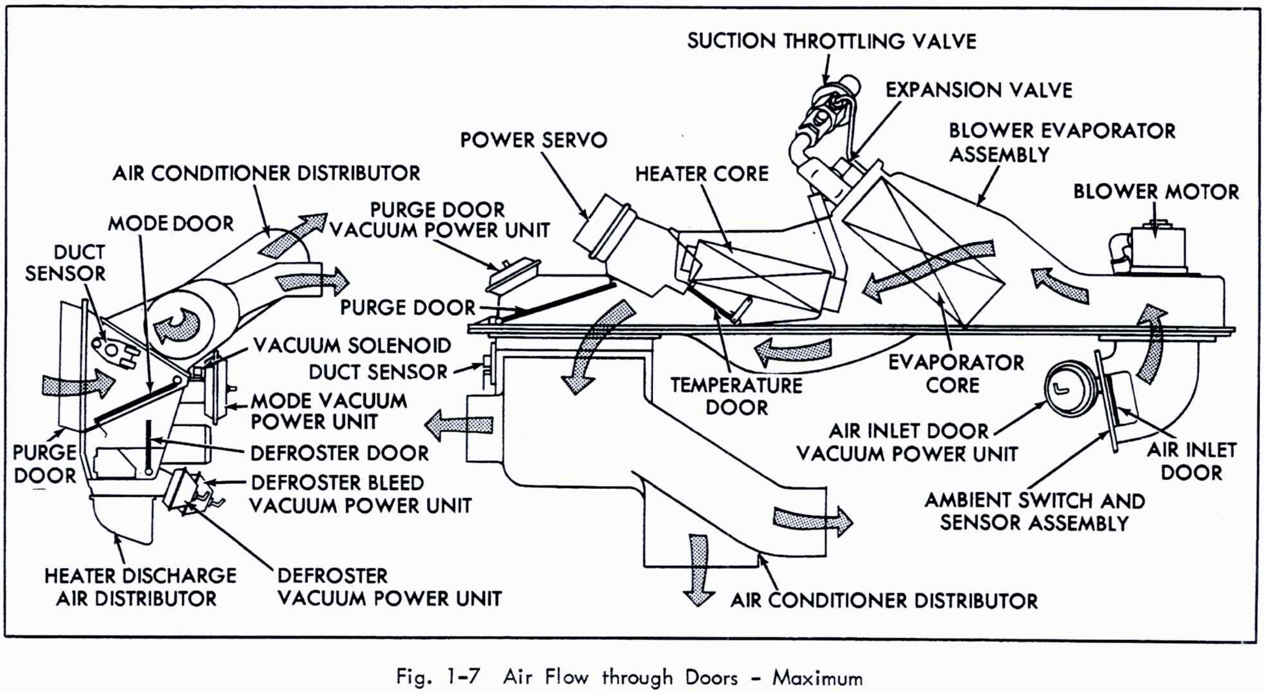


Fig. 1-7 Air Flow through Doors - Maximum Air Conditioning

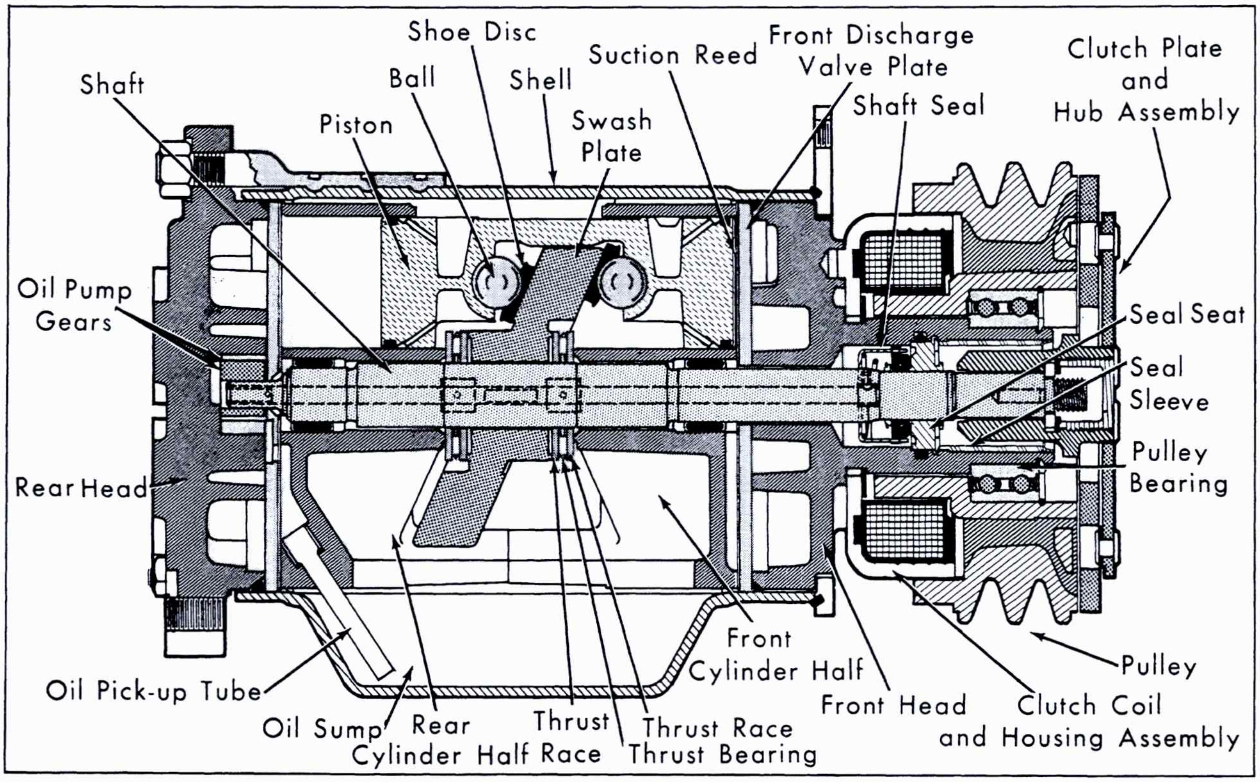


Fig. 1-8 Compressor Cross Section

compressor shaft, each of which operate in a front and a rear cylinder assembly. The pistons are actuated by a swash plate that is pressed on the compressor shaft. See Fig. 1-8. The cylinders have a bore diameter of 1-1/2 inches and a stroke of 1-3/16 inches, providing a total piston displacement of 12.6 cubic inches. Suction and discharge valve plates are located at the forward end of the front cylinder block and at the rear of the rear cylinder block.

A magnetic clutch is used to drive the compressor shaft. When voltage is applied to the clutch coil, the clutch plate and hub assembly, which is solidly coupled to the compressor shaft, is drawn by magnetic force rearward toward the pulley which rotates freely on the front head casting. The magnetic force locks the clutch plate and pulley together as one unit. The compressor shaft then turns with the pulley. When voltage is removed from the clutch coil, springs in the clutch plate and hub assembly move the clutch plate away from the pulley and the clutch plate and compressor shaft cease to rotate.

b. Condenser

The condenser is an alı inum, tube-and-fin heat transfer unit located directly forward of the radiator. The function of the condenser is to transfer heat from the refrigerant flowing through its tubes to the airstream drawn through it by the engine fan.

c. Receiver-Dehydrator

The receiver-dehydrator is a cylindrical, aluminum tank located on the right side of the condenser. It serves as a refrigerant reservoir. It has a pick-up tube which extends to the bottom of the tank; the refrigerant sight glass, provided as a means of determining whether there is adequate refrigerant in the system, is located at the top of this pick-up tube. A cloth sack filled with moisture-absorbing granules is located inside the cylinder to trap out any traces of moisture that may have got into the system. A screen is located on the bottom end of the pick-up tube.

d. Expansion Valve

The expansion valve is located on the evaporator and blower assembly. See Fig. 1-3. This valve controls the flow of refrigerant to the evaporator core by sensing the temperature of the outlet pipe of the core through a pressurized, temperature-sensitive bulb clamped to the outlet pipe, and by sensing the pressure at the exit of the evaporator through the equalizer line connected to the suction throttling valve. The valve meters the flow of refrigerant in response to these pressure and temperature signals, to keep the core full of liquid refrigerant and assure maximum cooling efficiency. The valve is preset at the factory and is not adjustable. See Fig. 1-9 for cross section of valve.

e. Evaporator

This assembly, shown in Fig. 1-3, is described in part in the air delivery section. One component, the oil bleed line, was not covered in that

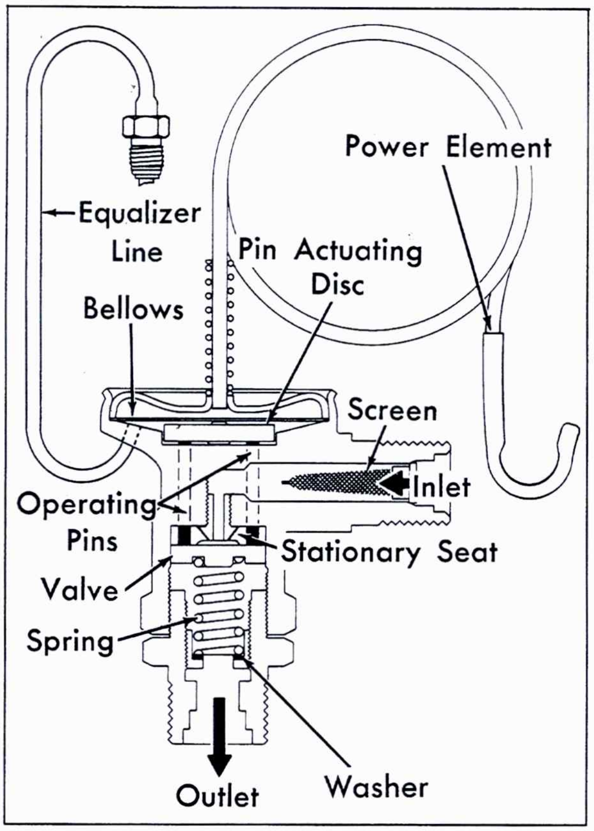


Fig. 1-9 Expansion Valve Cross Section

section. The oil bleed line is a small diameter aluminum tube routed from the inlet tank of the evaporator core to a fitting on the outlet side of the suction throttling valve. This line serves to protect the compressor during periods of low refrigerant charge. When refrigerant charge is low, oil return to the compressor through the outlet pipe of the evaporator is greatly impaired; the oil bleed line acts as a bypass to assure that oil, mixed with liquid refrigerant 12, will be returned to the compressor.

A check valve is incorporated in the oil bleed line at the fitting on the suction throttling valve. This valve starts to open with 5 psi pressure differential across it and is fully open at 12 psi. Below 5 psi the check valve is closed to prevent loss of capacity. This feature prevents refrigerant from bypassing the evaporator core during traffic and low speed conditions when cooling demands are greatest.

f. Suction Throttling Valve

The suction throttling valve is attached to the evaporator outlet pipe. See Fig. 1-3 for location and Fig. 1-10 for a cross-section. The sole function of this valve is to throttle the flow of refrigerant from the evaporator so that a constant pressure of 29 psi ± .5 psi is maintained in the core. At this pressure the evaporator tubes and fins are maintained at approximately 32°F. If the pressure in the core were allowed to drop much below 29 psi, ice would form in the core and block air flow. The capability of the valve to maintain 29 psi is, of course, limited by compressor capacity; at low compressor speed and high evaporator load the evaporator pressure may be greater than 29 psi, and the valve will be wide open.

The valve is controlled in operation by opposing forces on the valve piston; evaporator pressure on one side of the piston is opposed by spring pressure and control pressure on the other side.

When evaporator pressure rises above 29 psi, this pressure is exerted against the piston and, by means of a small bleed hole in the piston, into the bellows chamber, where it is reduced to control pressure by the bellows-operated pilot needle valve. This evaporator pressure overcomes both the spring pressure and control pressure, causing the piston to open until a balanced position is reached, at which evaporator pressure returns to the setting desired.

When evaporator pressure drops below 29 psi, spring pressure overcomes evaporator pressure, causing the piston to close down until the evaporator pressure returns to 29 psi.

g. Refrigeration Cycle

Refer to Fig. 1-11 for a generalized schematic of the refrigeration system showing relationship

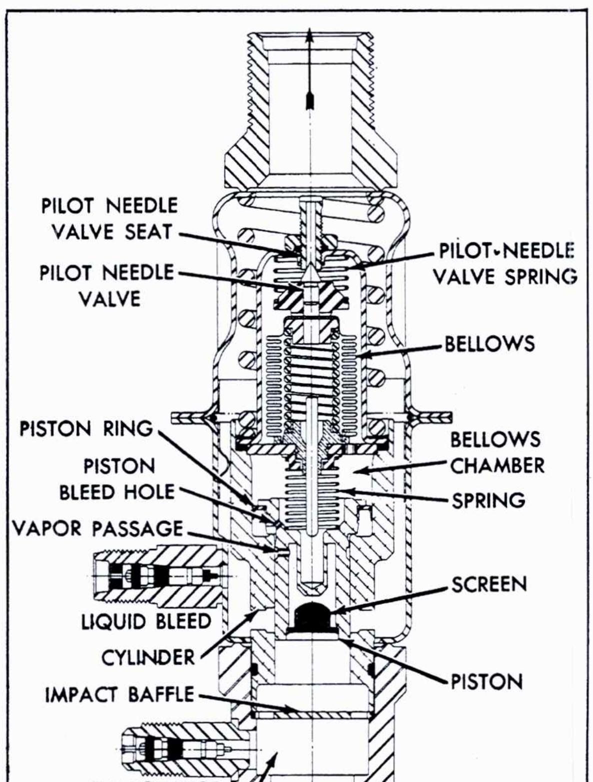


Fig. 1-10 Suction Throttling Valve Cross Section

of components. The compressor discharges high temperature, high pressure vapor that contains heat absorbed in the evaporator plus heat imparted to it by the compressor in the compression process. This vapor flows through two parallel tubes in the condenser where it releases heat to the airstream and changes to a medium temperature, high pressure liquid. This liquid flows to the receiver-dehydrator; from there it flows through the pickup tube past a sight glass and through the liquid line to the expansion valve on the evaporator assembly. At the flow control orifice in the expansion valve, the medium temperature, high pressure liquid changes to a low temperature, low pressure liquid and vapor mixture. This cold, foamy mixture enters the evaporator core at the bottom end and flows through parallel tubes upward through the core. Heat from the warm air-stream passing through the core is transferred to the refrigerant, vaporizing the liquid. Under high load conditions all the liquid is vaporized in the evaporator and only vapor flows through the suction throttling valve and the suction line to the compressor. The heat-laden vapor is drawn into the compressor and the cycle is repeated.

AUTOMATIC TEMPERATURE CONTROL SYSTEM

Control Panel Settings

The temperature control system provides automatic regulation of car interior temperature regardless of outside temperature changes. The owner control panel, Fig. 1-12, provides a temperature control dial with a temperature range of 65°F to 85°F. The "Auto" lever setting is supplemented by six additional settings which provide owner control for unusual conditions. The system operation at various owner lever settings is as follows:

VENT - Unheated, uncooled outside air is delivered through the air conditioner outlets at a fixed low blower speed. The compressor clutch is not engaged, and the heater water valve is closed. System turn-on is immediate.

OFF - Air flow into the passenger compartment is blocked by the purge door. Air is circulated through the evaporator and heater assembly at a fixed low blower speed and discharged into the engine compartment through the purge air opening. The compressor clutch is not engaged, and the

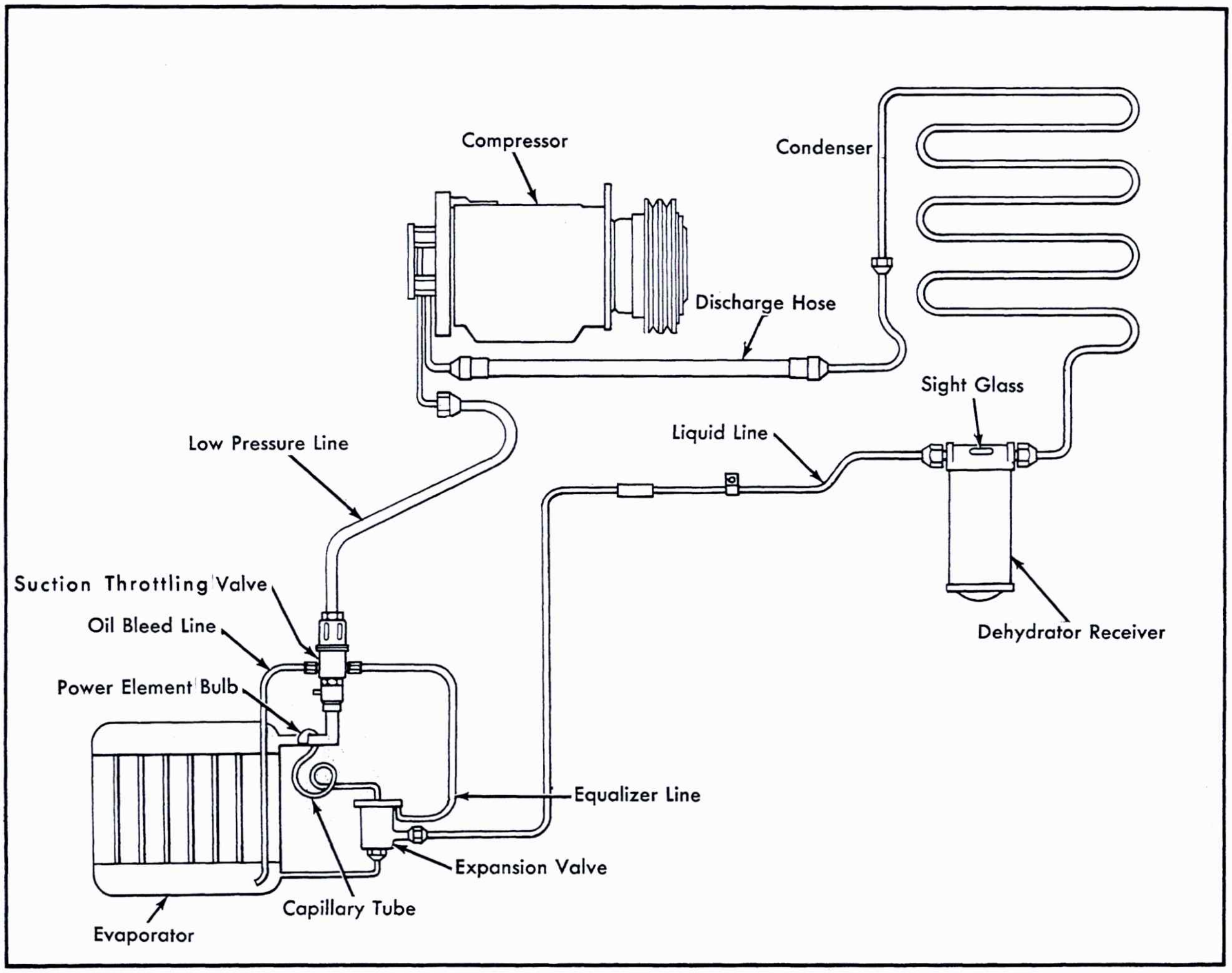


Fig. 1-11 Refrigeration Cycle

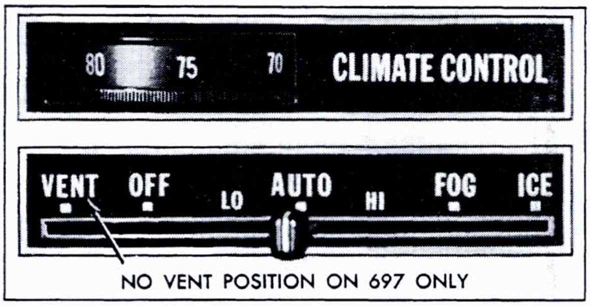


Fig. 1-12 Control Panel

heater water valve is closed. The automatic temperature control components are electrically energized and ready for turn-on.

AUTO - Regulation of system turn-on, discharge air temperature, air delivery mode, compressor operation, and blower speed is provided automatically. Immediate system turn-on will occur when air conditioner operation is required. In cold weather, system turn-on is delayed until warm water is available. Air at temperatures above approximately 90°F is discharged from the heater distributor. Air at temperatures below approximately 90°F is discharged through the air conditioner outlets. Compressor operation is provided at all ambient temperatures above approximately 32°F even when not required for cooling to insure maximum dehumidification of the air.

LO - Operation in the "LO" setting is identical to the "Auto" setting except that the blower operates at a fixed low speed.

HI - Operation in the "HI" setting is identical to the "Auto" setting except that the blower

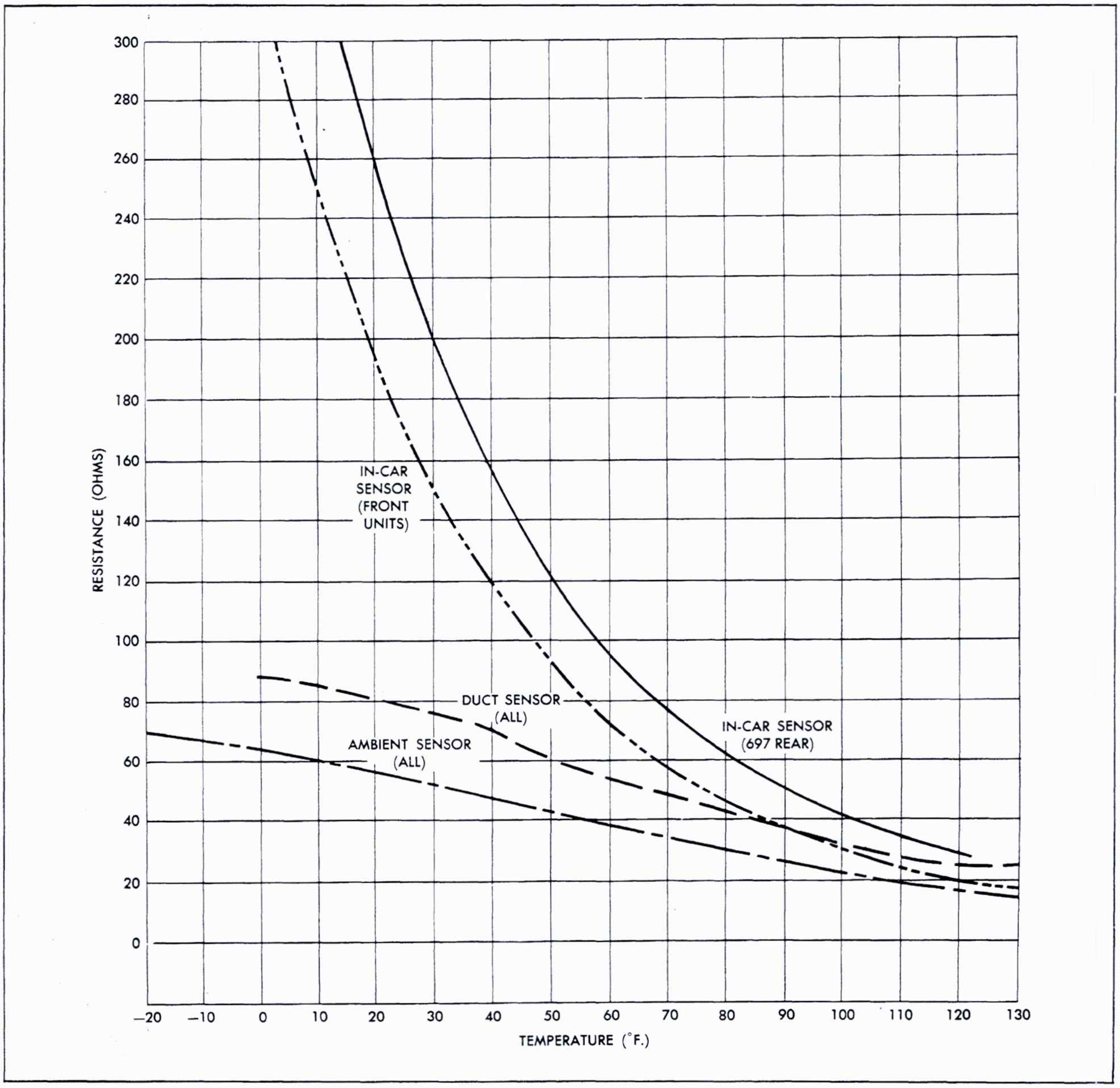
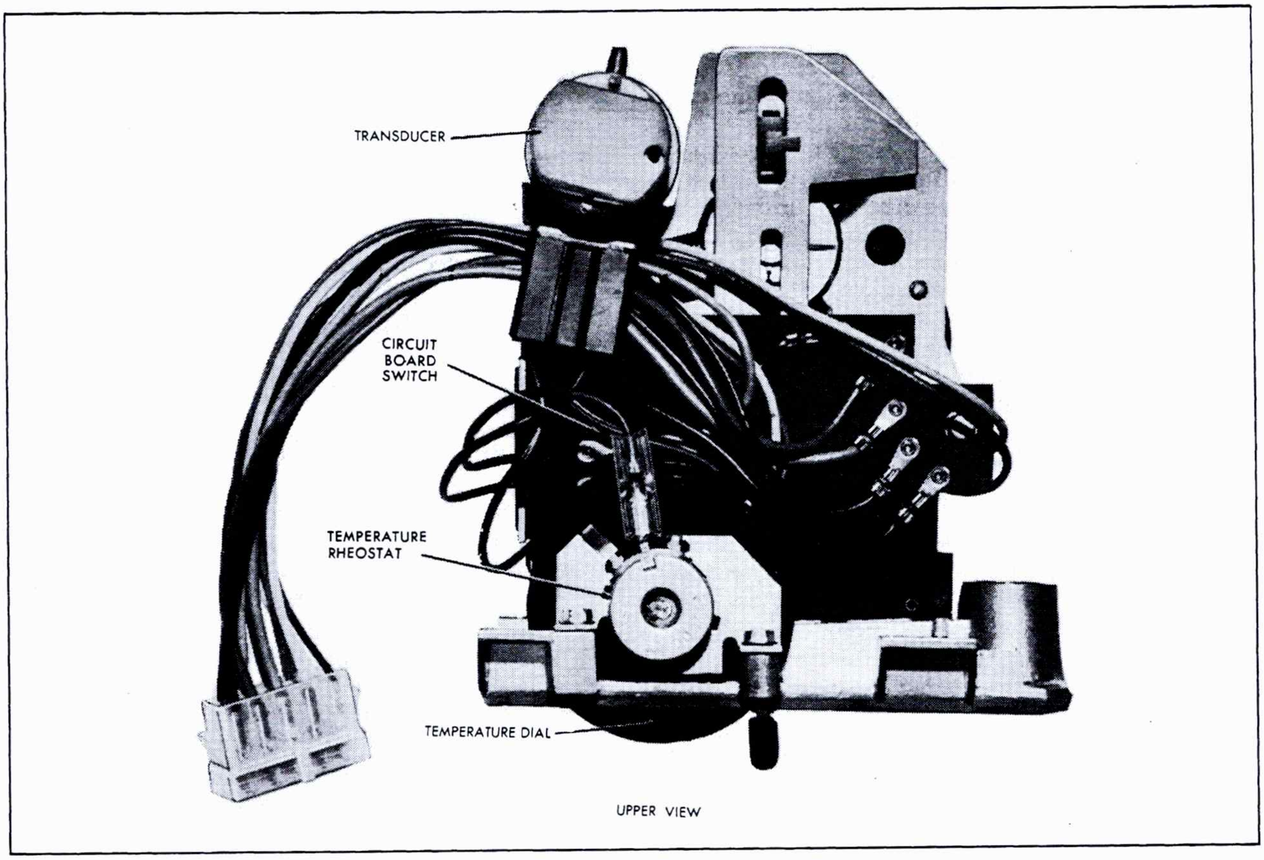


Fig. 1-13 Resistance Graph of Sensors



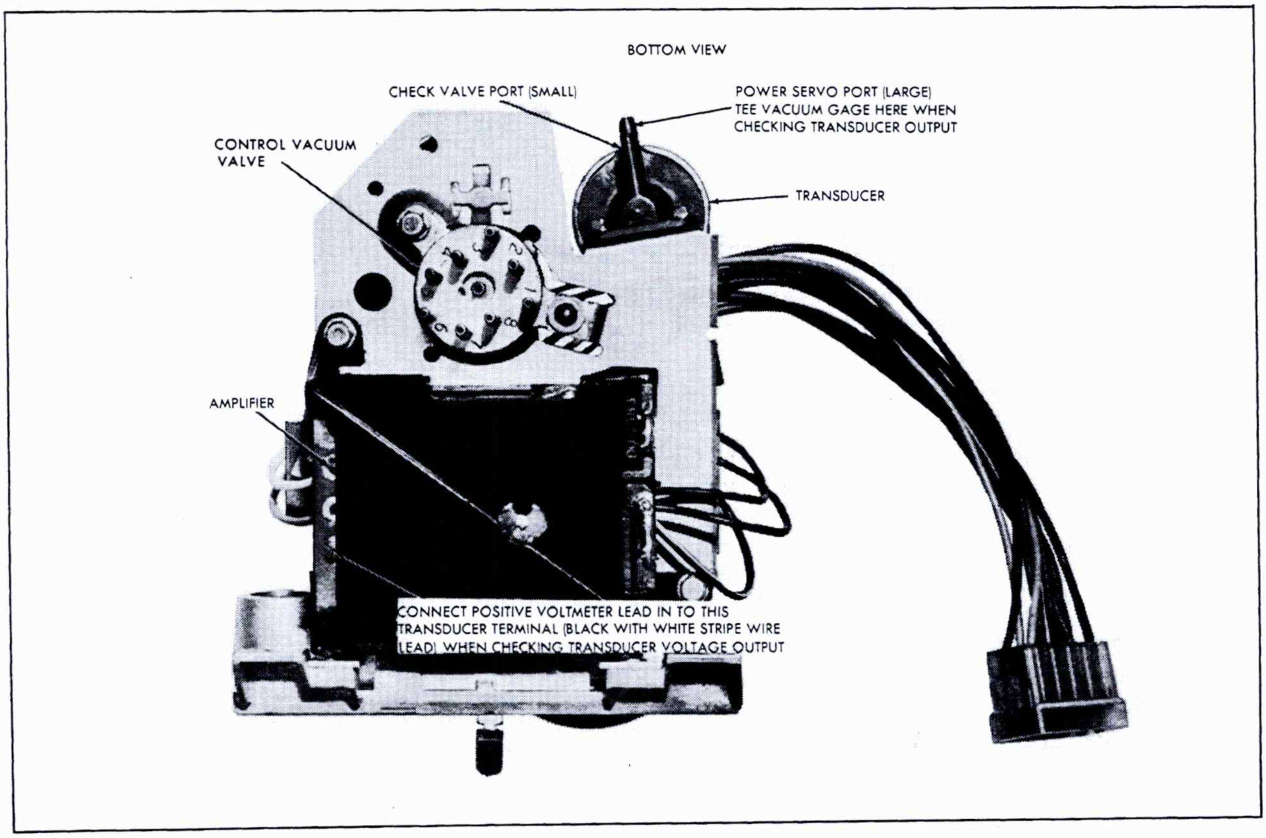


Fig. 1-14 Control Panel - Top and Bottom Views

operates at a fixed maximum speed and recirculated air is used when maximum air cooling is required. This setting is provided for quickest possible cooldown under extreme hot ambient conditions.

FOG - Temperature and blower regulation are automatically provided as in the "AUTO" setting except that the outlet air is directed, through the defroster outlets, to the windshield. System turn-on is immediate and does not depend on engine water temperature. Compressor operation is provided for ambients above approximately 32°F.

ICE - Operation in the "ICE" setting is identical to the "FOG" setting except that the blower operates at a fixed maximum speed.

Control System Components

Following is a list and a brief description of the components which perform the automatic temperature control functions. System operation and component part function in the system is explained in a subsequent section.

a. Sensors

A sensor (thermistor) is a type of resistor whose resistance value varies inversely to temperature, Fig. 1-13. As the temperature rises, the resistance value decreases; as the temperature falls, the resistance value increases. Three sensors are used:

(1) The in-car switch and sensor assembly is a dual-function component mounted in a grille-enclosed chimney in the instrument panel upper cover to sense passenger compartment temperature and sun load on the car.

(2) The discharge air sensor is mounted on the left side of the mode selector case and senses the temperature of the air being discharged into the passenger compartment.

(3) The compressor switch and ambient sensor assembly is a dual-function component, located in the air inlet assembly behind the right hand shroud side kick pad, which senses the temperature of outside air entering the system.

b. Control Panel Assembly

The control panel assembly is located in the instrument panel cluster to the left of the steering column and consists of a number of closely related parts, Fig. 1-14.

(1) The temperature dial is graduated in 5°F divisions between 65°F and 85°F, permitting selection of any interior temperature within this range. The temperature dial controls a rheostat, the resistance of which is set by the position of the temperature dial.

(2) The amplifier, mounted on the underside of the control panel baseplate, is a two-stage DC amplifier that provides a voltage output proportional to the input signal from the sensor string. It is constructed of two transistors on a small circuit board, with compensation for temperature or voltage changes provided through the use of selected resistors. A protective diode is included to clip inductive voltage spikes that might otherwise damage components of the amplifier. The amplifier is mounted with a plastic cover for protection against accidental shorts during assembly or service operations. The amplifier should be serviced only as an assembly. No attempt should be made to repair an amplifier except by an experienced electronics technician equipped with the proper service aids for calibration.

(3) The transducer, mounted at the rear of the control panel baseplate is an electro-mechanical device which modulates vacuum by converting the DC voltage signal from the amplifier into an inversely proportionate vacuum output.

(4) The circuit board electrical switch is mounted on the upper side of the control panel baseplate. Attached to and positioned by the control lever are wiper contacts which ride on the circuit board pads to provide the desired electrical circuit connections. A protective diode is included to clip inductive voltage spikes from the compressor clutch coil which would shorten the life of the circuit board. Electrical wires from the circuit board switch and from the amplifier are brought to a single ten-way connector body.

(5) The control vacuum valve, located on the underside of the control panel baseplate, is an eight-port rotary vacuum valve positioned by the control lever to perform auxiliary vacuum functions, Figure 1-26 shows the internal porting of the control vacuum valve for each lever setting.

c. Power Servo Assembly

The power servo assembly is mounted on the heater and air modulator in the engine compartment. It is composed of several basic parts: a vacuum operated power diaphragm and arm assembly, a rotary vacuum valve, a blower circuit board and resistor assembly, an air mix door link, a housing, and a dust cover.

The sequence of events in the control program as the power servo is moved from maximum air conditioning to maximum heating is as follows:

1. Availability of recirculated air is terminated.
2. Blower speed drops from High to Med-3.
3. The heater water valve opens.
4. Blower speed drops from Med-3 to Med-2.
5. The air mix door begins to move, blending air.
6. Blower speed drops from Med-2 to Med-1.
7. Air delivery mode shifts from air conditioner to heater.
8. Blower speed goes from Med-1 to Med-2.
9. Blower speed goes from Med-2 to Med-3.
10. Blower speed goes from Med-3 to High.

The sequence of events is reversed as the power servo is moved from maximum heating to maximum air conditioning.

d. Solenoid Vacuum Valve (Fig. 1-15)

The solenoid vacuum valve, located on the right

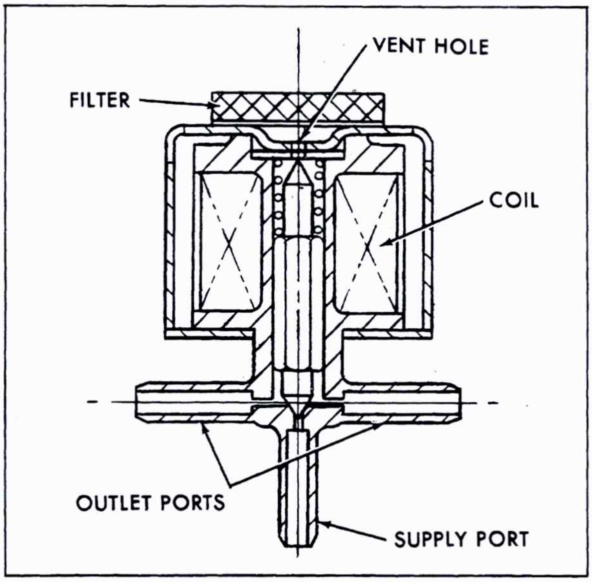


Fig. 1-15 Solenoid Vacuum Valve

side of the mode selector case in the passenger compartment, is an electro-mechanical device which controls vacuum supply to the purge door actuator and the defroster bleed actuator. When the coil is not energized, the supply port is sealed and the output ports are vented to atmosphere. When the coil is energized, the supply port connects to the output ports and the atmospheric vent hole is sealed.

e. Blower Relay

The blower relay is located on the front of the heater and air modulator case and is used to provide the higher blower speeds required in the "AUTO", "HI", "FOG", and "ICE" lever settings. Actuation of the relay is not accomplished until a coil ground circuit is available through either the in-car switch, heater turn-on switch or by override in the control panel circuit board switch. Once energized, the relay provides a coil ground path internally to "latch" the relay and solenoid coils and prevent coil chatter.

f. Engine Heater Turn-On Switch

The engine heater turn-on switch is located in the front of the right hand cylinder head, Fig. 1-16 and senses engine water temperature. The switch is open when engine water is below approximately 120°F and closed above 120°F.

g. Defroster Bleed Delay Plug

The defroster bleed delay plug is a small, sintered metal plug inserted inside the green vacuum hose which feeds the defroster bleed actuator. The sintered metal plug provides a restriction to air flow and delays actuation of the defroster bleed function for a short period of time after the solenoid vacuum valve is activated.

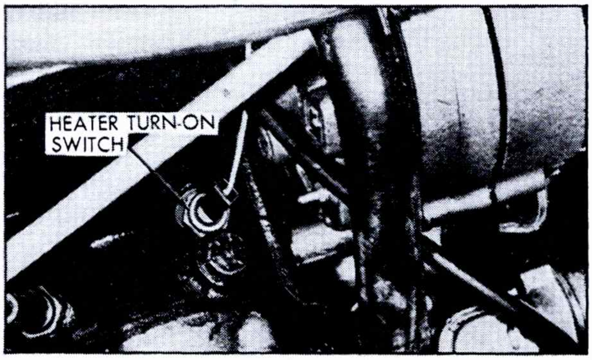


Fig. 1-16 Heater Turn-On Switch

h. Vacuum Check Valve and Connector Assembly

The vacuum check valve and connector assembly, located on the front surface of the heater and air modulator case in the engine compartment, is used to provide unchecked engine vacuum to the temperature control storage tank and to the park brake release actuator and checked vacuum to the temperature control function circuit. The check valve is provided to prevent system vacuum loss during periods of low engine vacuum.

i. Heater Water Valve

The heater water valve, located on the evaporator and blower case in the engine compartment, is a normally closed valve which requires vacuum actuation to be opened. The valve controls water flow to the heater core and is open in all temperature control program points except when maximum cooling is required. The water valve is closed in the "Vent" and "Off" lever settings and when the engine is not running.

j. Vacuum Storage Tank

The vacuum storage tank, located on the left side of the dash in the engine compartment, is a plastic tank with an integral check valve. The vacuum storage tank is used to provide volume to maintain vacuum to the temperature control components (transducer and power servo) during extended periods of low engine vacuum.

k. Vacuum Hose Assembly

The vacuum hose assembly is mounted primarily on the heater and mode selector units with branches to the air inlet assembly, control panel, heater water valve, and vacuum storage tank. The complete vacuum hose assembly consists of two separate hose assemblies, an in-car hose assembly and an underhood hose assembly, which are joined by a metal multiple nipple connector at the lower position of the heater case in the area of the dash. The connector bolts to the heater case and seals the opening. The in-car hose assembly is composed of vinyl hoses with multiple connectors molded on at the control panel end and at the end attaching to the dash connector. The

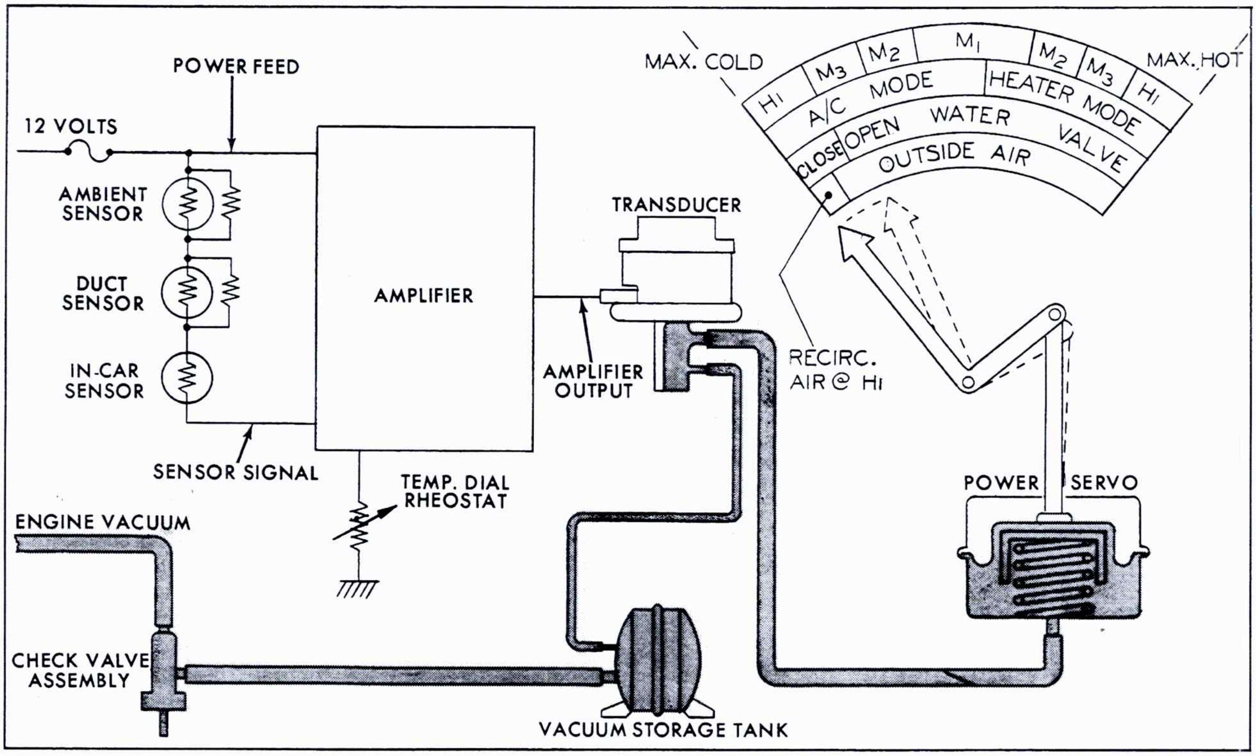


Fig. 1-17 Temperature Control Circuit

underhood hose assembly is composed of thick-wall rubber hoses to withstand the higher engine compartment temperatures and resist kinking.

Control System Operation

The automatic temperature control system is made up of four major sections which perform the following operations:

1. Temperature control.
2. System turn-on.
3. Blower speed control.
4. Auxiliary vacuum and electrical functions.

The above major sections will be described separately and in detail to aid system understanding and service diagnosis. Partial vacuum and electrical circuits are used to simplify operation explanation. In subsequent sections, complete vacuum and electrical circuit diagrams are analyzed.

a. Temperature Control Circuit (Fig. 1-17)

The automatic temperature control circuit utilizes three temperature-sensitive thermistors (sensors), strategically located in the car, to develop an electrical signal. The in-car sensor senses car interior temperature and sun load, the duct sensor senses the temperature of air being discharged into the car, and the ambient sensor senses the temperature of outside air entering the system. As has been noted, the resistance of a thermistor varies inversely to temperature. High temperature results in low resistance, and low temperature results in high resistance. A significant point of this temperature-resistance relationship is that an open sensor would represent very high resistance (low temperature) and force the system to maximum heat. Conversely, a shorted sensor would give a signal sufficient to force the system to maximum cooling. The electrical signal from the sensor string is fed to the amplifier to be amplified to a point where small variations at the sensors result in larger variations at the amplifier output which can be more readily used. At the point where the sensor string signal enters the amplifier, the temperature dial rheostat is provided to allow a bias to the input signal. Variations in the rheostat resistance (temperature dial setting) will change the amplifier output and thereby the temperature control program.

The amplifier output voltage is used to control the transducer which modulates engine vacuum. The voltage signal from the amplifier is converted into an inversely proportional vacuum signal at the transducer. (High voltage-low vacuum; low voltage-high vacuum.) The transducer receives vacuum input from the engine through a vacuum storage tank. The vacuum tank is equipped with a check valve and provides a volume to insure proper control during periods of low engine vacuum.

The modulated output vacuum from the transducer is used to position the power servo diaphragm and arm. The power servo arm is connected, by the air mix door link, to the air mix door. The position of the power servo, therefore, sets the angle of the air mix door which

determines the amount of heated air to be mixed with cooled air to arrive at the desired temperature of discharge air. A high vacuum input to the power servo results in heater operation; a low vacuum input results in air conditioner operation.

b. System Turn-On Circuit (Fig. 1-18)

System turn-on is accomplished when the purge door is opened, allowing airflow into the passenger compartment. System turn-on occurs, correctly, in three distinct ways:

1. Immediate turn-on when the car interior is warm, requiring air conditioner operation.
2. Delayed turn-on in cold weather until warm water is available from the engine for heater operation.
3. Immediate turn-on, regardless of temperatures, by owner override to the "VENT", "FOG", or "ICE" lever settings.

For the purpose of this discussion it will be assumed that the blower speed control system is operating satisfactorily. To obtain system turn-on it is necessary to supply vacuum to the purge door actuator and move the purge door to a position to direct air into the passenger compartment, Fig. 1-18. Vacuum supply for the purge door actuator is routed from the engine through a check valve, which is provided to prevent loss of vacuum supply during periods of low engine vacuum, to a through passage in the control vacuum valve. Routing through the control vacuum valve was done for design convenience and does not affect system turn-on. Supply vacuum is then routed to the solenoid operated vacuum valve which is the master vacuum control unit for system turn-on. Output vacuum from the solenoid vacuum valve is directed to the purge door actuator.

When the solenoid vacuum valve coil is not energized, the plunger seals the vacuum supply port and opens a vent hole to the port feeding the purge door actuator. The purge door is positioned, by spring loading, to seal the dash opening and direct air into the engine compartment through the purge air opening. When the solenoid vacuum valve coil is energized, the plunger is raised to seal the vent hole and connect the vacuum supply port to the output port. With vacuum supplied to the purge door actuator air is directed into the passenger compartment.

Electrical energy to the solenoid vacuum valve coil may be supplied in three ways which correspond directly to the three manners of system turn-on described earlier. Electrical source for the solenoid coil is from the ignition switch to the control panel circuit board switch and to the coil. To complete the electrical circuit a ground path must be located. There are three possible paths to ground: the heater turn-on switch, the in-car switch, and the vent-fog-ice override in the control panel circuit board switch. In a typical winter startup, the in-car switch, located with the in-car sensor in the instrument panel upper cover, would be open. The vent-fog-ice override would be open. (In LO, AUTO or HI). For engine temperatures below 120°F, the engine turn-on switch would be open until the engine warms up. When the engine water is warm (above approximately 120°F), the heater turn-on switch closes to complete the electrical circuit and effect system turn-on. In a hot weather start the in-car switch will be closed (above approximately 78°F) to allow immediate turn-on in air conditioner. It should be noted here that because of in-car switch setting tolerance, all cars may not turn-on in garage

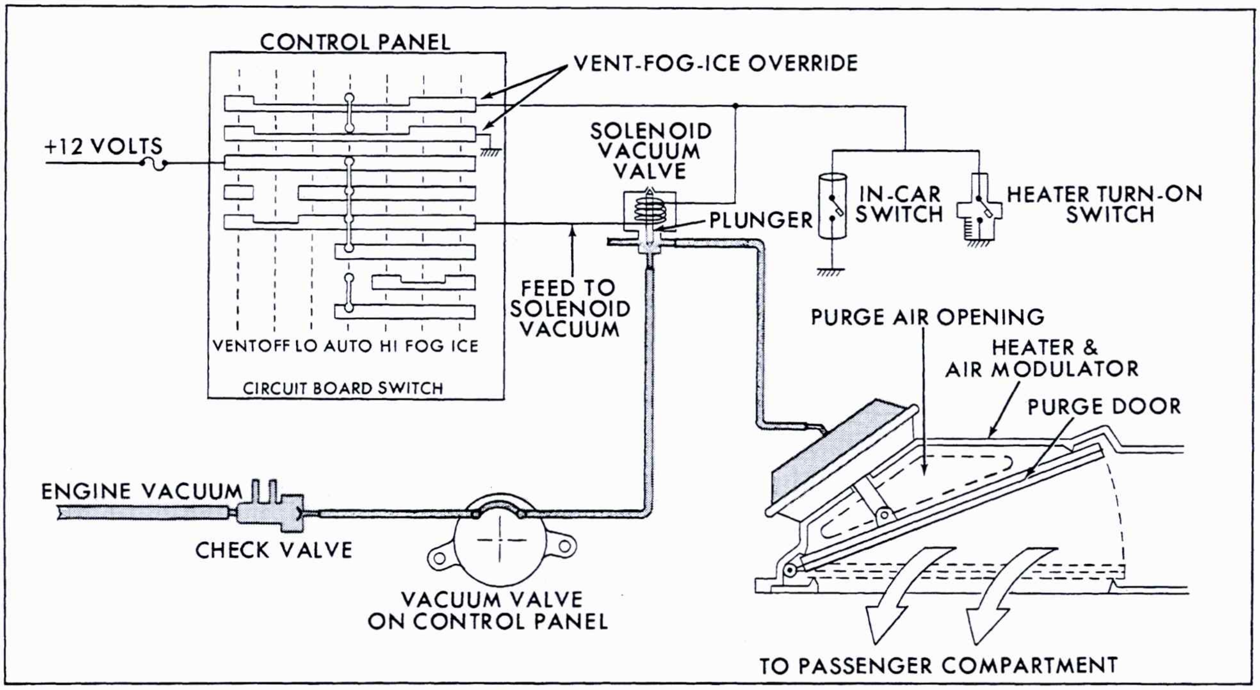


Fig. 1-18 System Turn-On Circuit

ambients. Finally, if the owner selects "VENT", "FOG", or "ICE" lever settings, the ground path is provided in the control panel circuit board, and system turn-on is immediate regardless of temperatures.

c. Blower Speed Control Circuit (Fig. 1-19)

Three ranges of blower speed are used in the automatic temperature control system:

1. Fixed low blower speed.
2. Four blower speeds automatically controlled by power servo position, ranging from a Med-1 speed slightly higher than fixed low blower speed to a maximum blower speed.
3. Fixed high blower speed.

The different blower speeds are obtained by use of electrical circuits as shown in Fig. 1-19. The low blower circuit is through the ignition switch and 10 amp fuse to the power servo circuit board and resistor assembly. At the power servo the low blower circuit goes through all four resistors and then to the blower motor. It should be noted that the low blower circuit is energized any time the ignition switch is on. The low blower speed is used at the "VENT", "OFF", and "LO" lever settings. The position of the purge door determines whether the air is directed into the passenger compartment or through the purge air opening into the engine compartment.

The blower relay is used to obtain a more direct feed, from the starter solenoid battery terminal, when the control lever is in "AUTO", "HI", "FOG" or "ICE". The relay coil feed is from the ignition switch, through the 25 amp heater-A/C fuse to the control panel circuit board switch where the circuit is continuous only in "AUTO", "HI", "FOG", or "ICE". From the control panel current flows to the relay coil. In order to complete the circuit a ground path must be located in the same manner as the solenoid vacuum valve coil ground was completed. Possible ground circuits are through the in-car switch, through the heater turn-on switch, or through the fog-ice override in the control panel circuit board. Once the relay is energized, an internal ground path within the relay is closed to "Latch" the relay. With the relay energized and the control lever in the "AUTO" or "FOG" setting, blower motor feed is from the starter solenoid through the relay to the power servo circuit board and resistor assembly and to the blower motor. The four automatic blower speeds are regulated by voltage to the blower motor through the selective use of three resistors mounted on

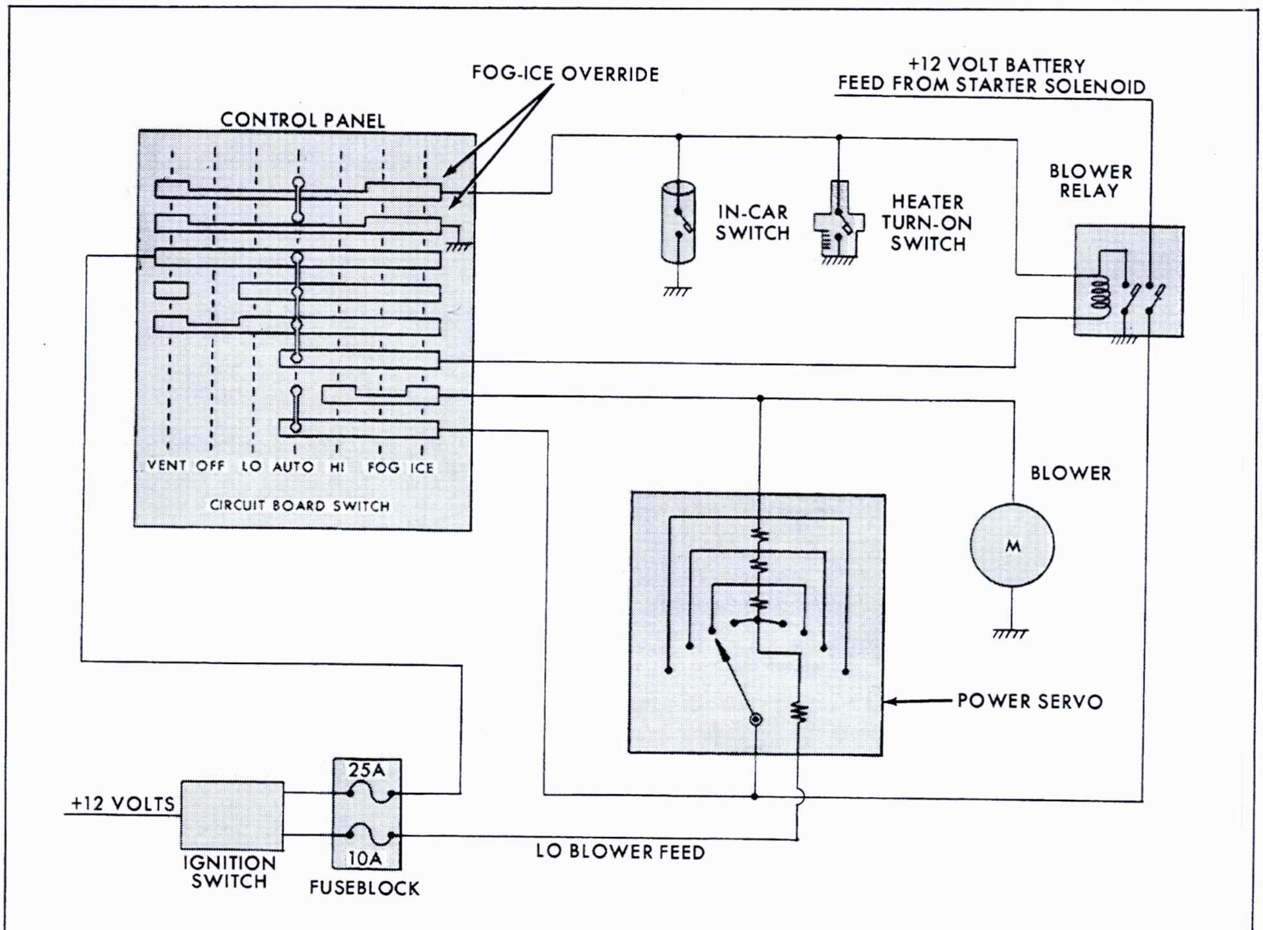


Fig. 1-19 Blower Speed Circuit

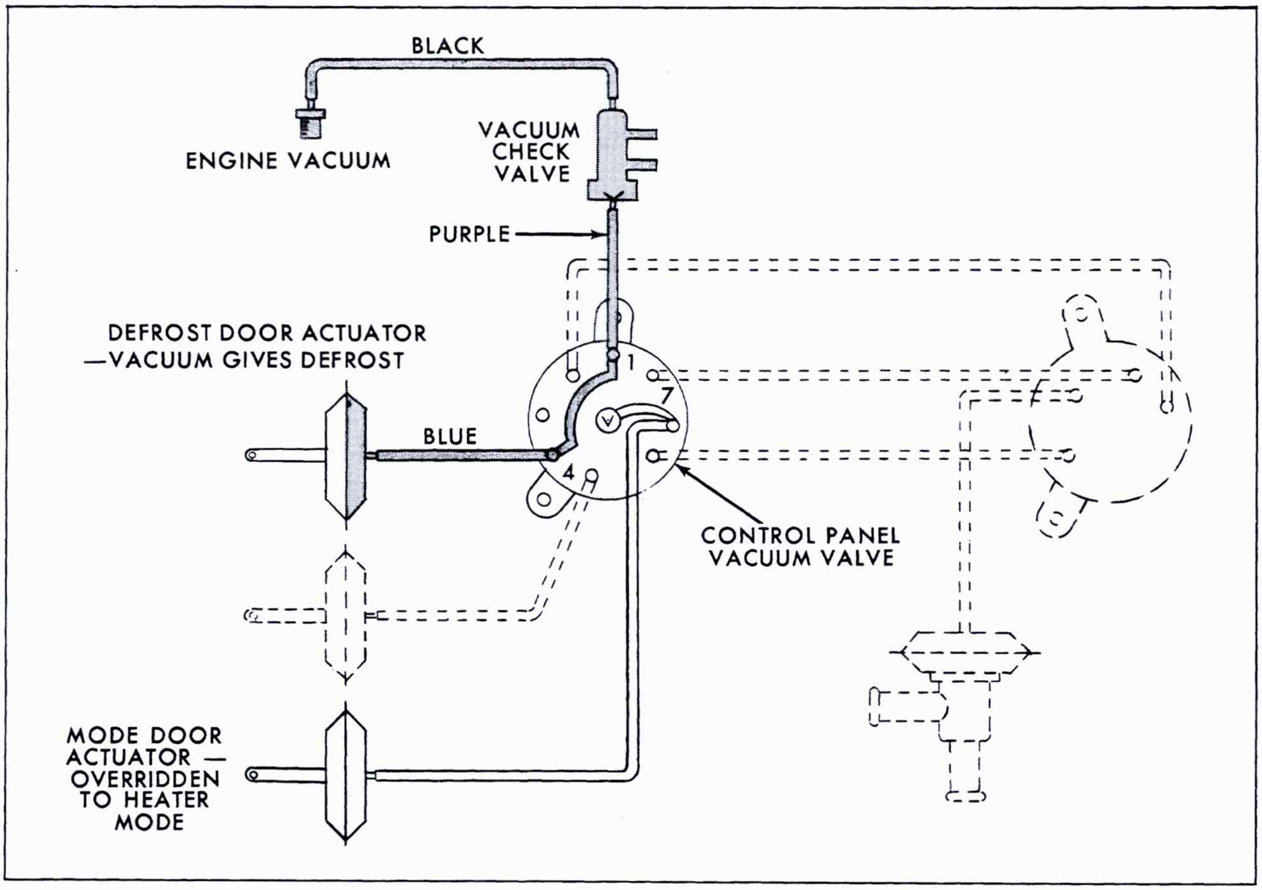


Fig. 1-20 Defroster Door Vacuum Circuit

the power servo circuit board. Circuit paths through or around the resistors are selected by wiper contacts, attached to and positioned by the power servo arm, which slide across the circuit board pads.

In the "HI" and "ICE" lever settings an additional circuit path is provided by the control panel wiper contacts connecting the bottom two circuit board pads. The path bypasses the resistors in the circuit board and the blower operates at a fixed maximum speed.

d. Auxiliary Vacuum & Electrical Function Circuits

In addition to discharge air temperature control, system turn-on, and blower speed control, there are several additional functions which are determined by either control lever setting or the power servo position. The auxiliary functions are:

1. Defroster door actuation
2. Recirc door actuation
3. Mode door actuation
4. Heater water valve control
5. Defroster bleed door actuation
6. Operation of the compressor

In the following articles the above functions and the way in which they are accomplished will be separated from the complete system. In subsequent sections the total vacuum and electrical systems will be analyzed.

The Defroster Door Vacuum Circuit (Fig. 1-20)

Vacuum from the engine fitting is routed through the vacuum check valve to the control panel vacuum valve at port #1. Port #1 and port #4 are connected only in the "FOG" or "ICE" lever setting. Control vacuum valve port #4 connects directly to the defroster door actuator through a blue color-coded vacuum hose. Vacuum at the defroster door actuator is required to obtain defroster operation. It is also necessary that the mode door be positioned for heater delivery to obtain defroster operation.

The Recirc Air Door Vacuum Circuit (Fig. 1-21)

The temperature control system operates on full outside air in all lever settings and all control program points except maximum air conditioning in the "HI" lever setting. When maximum cooling is indicated and the control lever is in the "HI" setting, the recirc door in the air inlet assembly is moved to a position which permits approximately 80% recirculated air to be mixed with 20% outside air. The recirc door vacuum circuit is shown in Fig. 1-21. Since the recirc door actuation must meet two conditions, it is

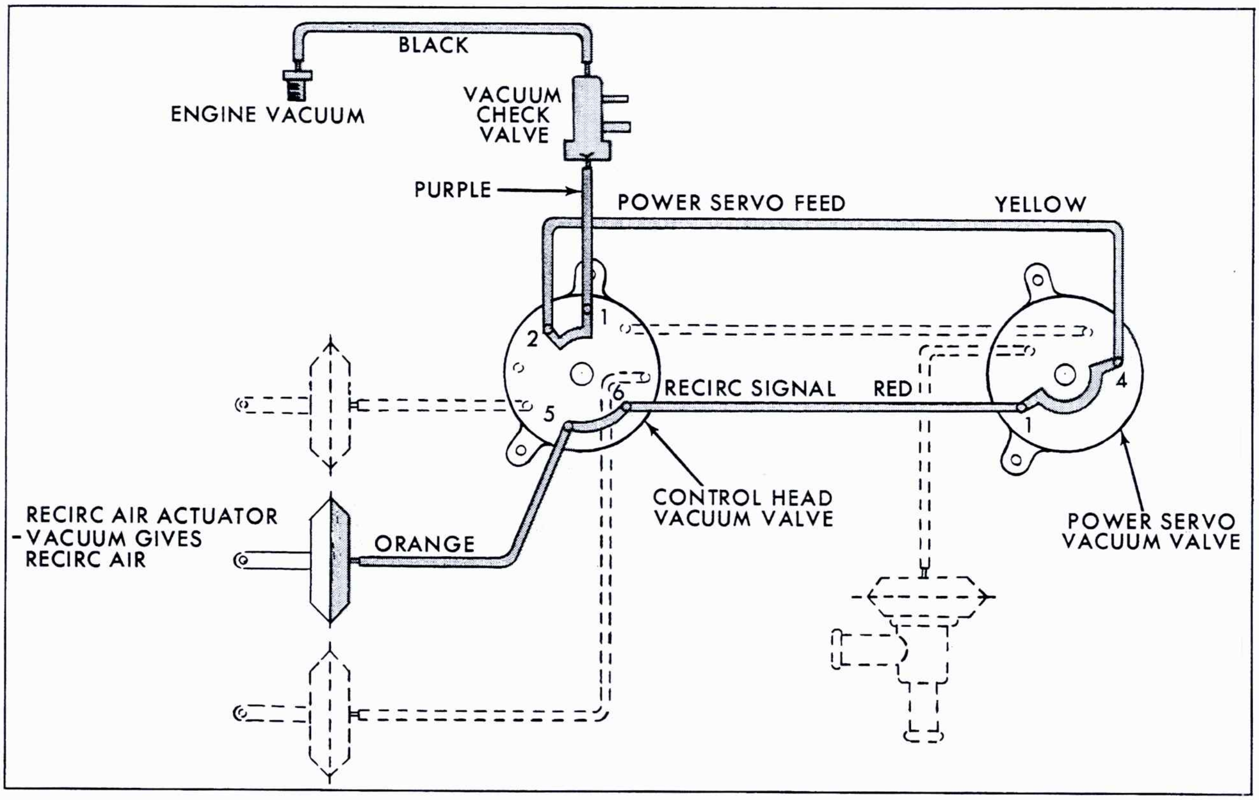


Fig. 1-21 Recirc. Air Vacuum Circuit

referenced to both the control panel vacuum valve and the power servo vacuum valve. Vacuum from the engine is routed through the vacuum check valve to the control head and by the yellow-coded power servo feed hose to the power servo vacuum valve. If the power servo actuator is in the maximum cooling position, port #4 connects to port #1 on the servo vacuum valve and a recirc signal is relayed back to the control head vacuum valve via the red-coded vacuum hose. If the control panel lever is in the "HI" setting, port #6 will connect to port #5 to pass vacuum on to the recirc door actuator. Vacuum at the recirc door actuator is required for recirc operation. If the control panel lever is not in the "HI" setting, port #6 will be blocked and port #5 vented to stop the signal.

The Mode Door Vacuum Circuit (Fig. 1-22)

Determination of air delivery mode (heater or air conditioner) is normally a function of the temperature control program and is set by the position of the power servo. It is necessary, however, to be able to override the program for heater mode in the "FOG" and "ICE" settings; consequently, the mode door vacuum circuit is referenced to both the control panel and power servo vacuum valves. Vacuum from the engine travels the usual route through the vacuum check valve, control panel vacuum valve ports #1 and #2, and yellow-coded power servo feed hose to reach the power servo vacuum valve. If the servo is positioned for air conditioner delivery, servo vacuum valve ports #3 and #4 are connected. If the servo is positioned for heater delivery, servo vacuum valve port #3 is vented. In either case the vent or vacuum signal is relayed to the control panel vacuum valve via the brown-coded mode signal hose. At all control panel lever settings except "FOG" and "ICE" control vacuum valve ports #8 and #7 are connected to transfer the servo program signal via the tan-coded hose to the mode door actuator. In the "FOG" and "ICE" lever settings port #7 is vented to force heater mode. Vacuum at the mode door actuator results in air delivery from the air conditioner outlets. With no vacuum the mode door is spring-loaded to the heater position.

The Heater Water Valve Vacuum Circuit (Fig. 1-23)

The heater water valve is a normally closed valve which controls water flow to the heater core. The water valve is always closed in the "VENT" and "OFF" lever settings. In the remaining control lever settings the water valve is open except when the power servo is positioned for maximum cooling. The heater water valve vacuum circuit is shown in Fig. 1-23. Vacuum from the engine is routed through the vacuum check valve to the control panel vacuum valve

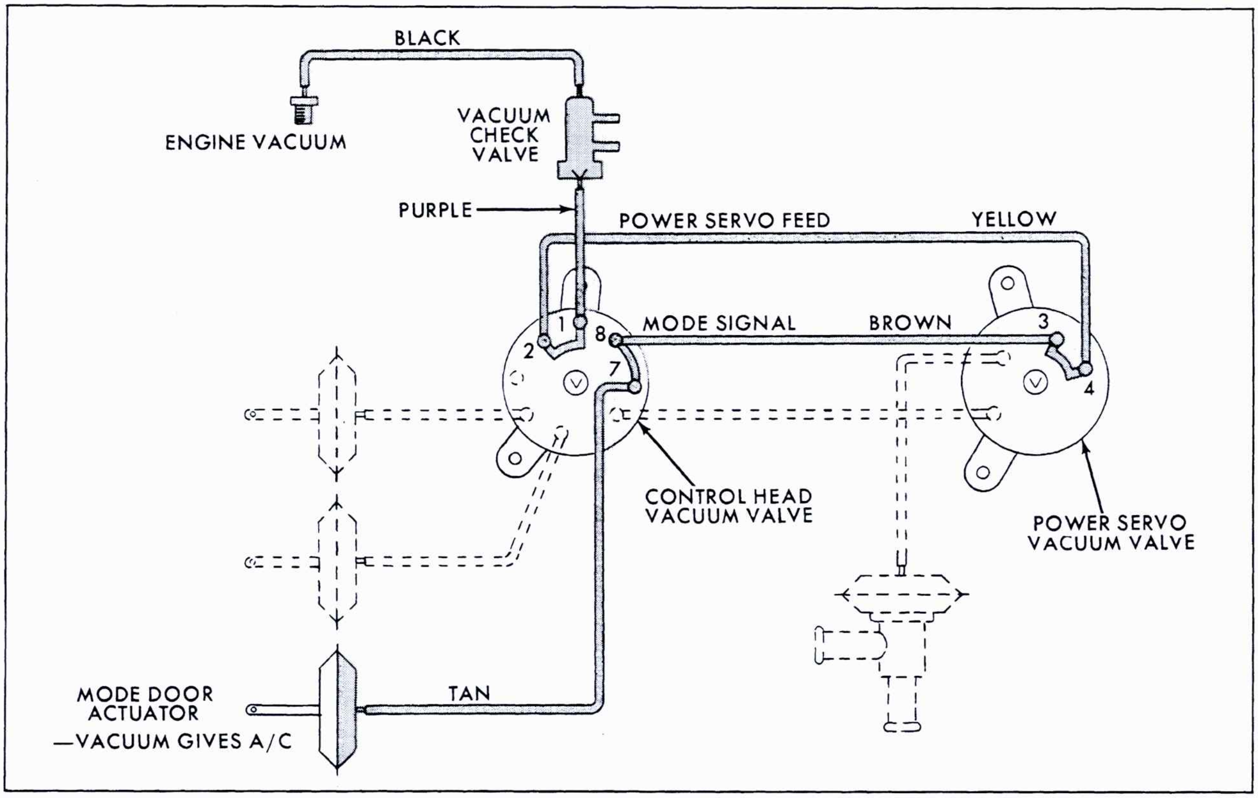


Fig. 1-22 Mode Door Vacuum Circuit

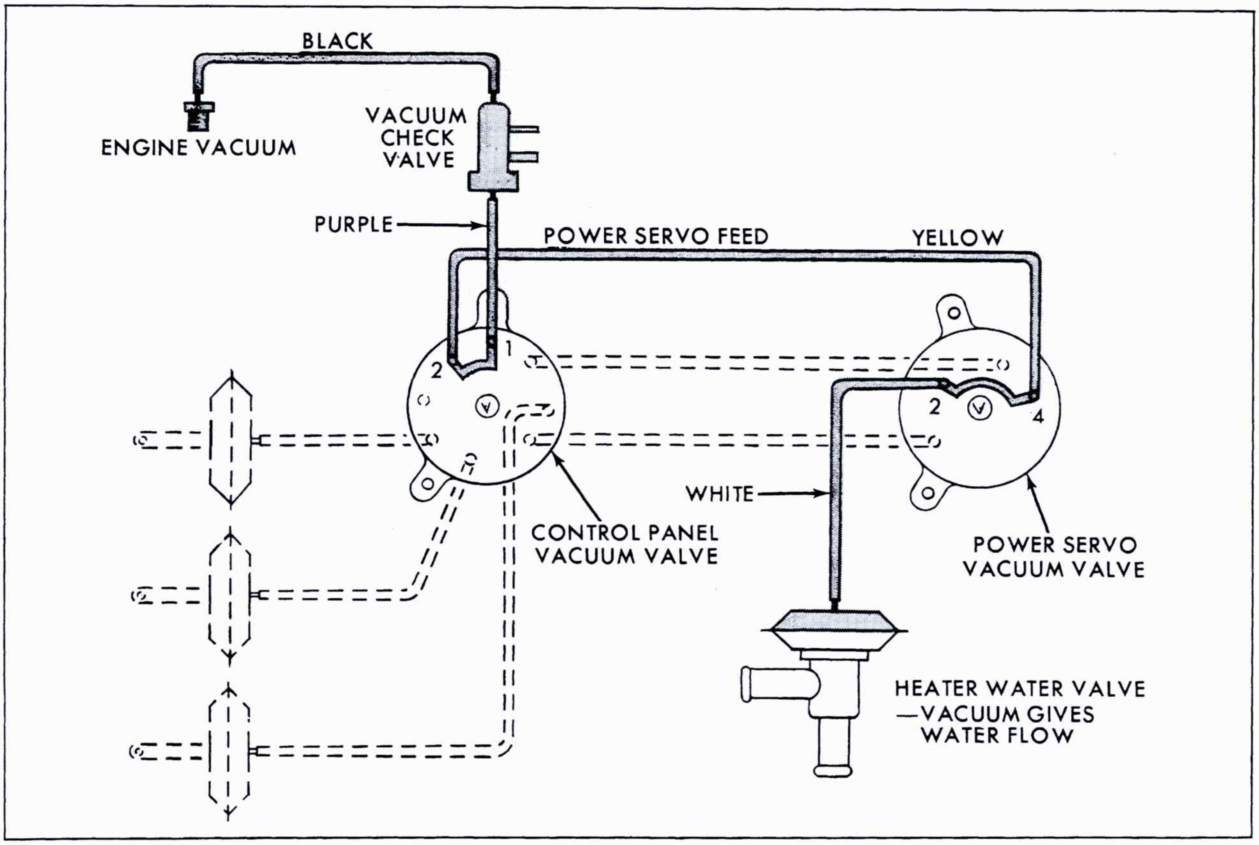


Fig. 1-23 Heater Water Valve Vacuum Circuit

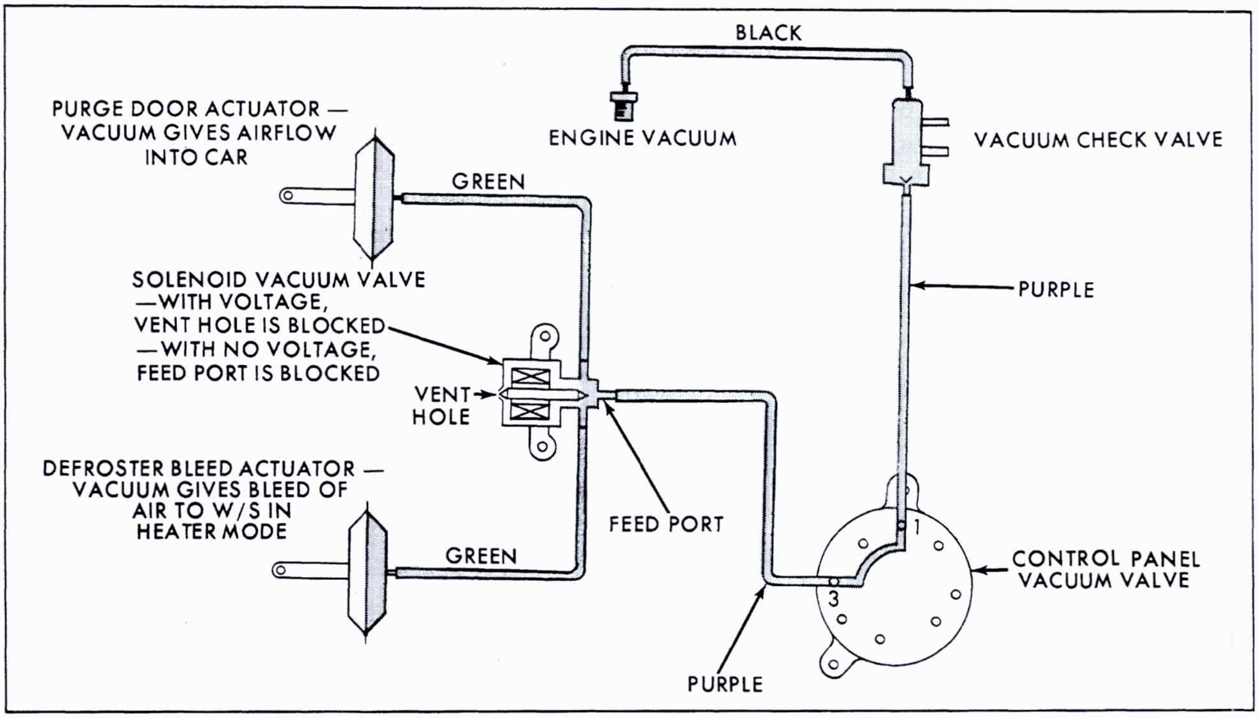


Fig. 1-24 Defroster Bleed Vacuum Circuit

port #1. In all lever settings except "OFF" control valve ports #1 and #2 are connected to transfer engine vacuum to the power servo vacuum valve via the yellow-coded power servo feed hose. In the "OFF" lever setting, control valve port #2 is vented to insure closing the water valve. At the power servo vacuum valve, port #4 connects to port #2 in the heater and mild air conditioner portions of the temperature control program. When the power servo is positioned for maximum or near maximum cooling, servo valve port #2 is vented. From port #2 the signal to the water valve is transferred via a white-coded vacuum hose. Vacuum to the water valve diaphragm is required to open the water valve.

The Defroster Bleed Vacuum Circuit

When the temperature control system is operating in the heater mode, it is desirable to bleed a small amount of discharge air to the windshield to prevent fog buildup. The defroster bleed vacuum circuit is shown in Fig. 1-24. It should be noted that the defroster bleed actuator is connected in parallel to the purge door actuator. The vacuum supply circuit is described in detail in system turn-on circuit, Page 1-15. Briefly, engine vacuum is routed through the vacuum check valve to control panel port #1 and through a common passage in the control valve to port #3. From the control panel vacuum valve the supply vacuum is fed via the purple-coded hose to the solenoid vacuum valve. When the solenoid vacuum valve is energized, vacuum passes to the defroster bleed actuator (and the purge door actuator) through a green-coded hose. Inserted into the green-coded hose at the defroster bleed actuator is a porous sintered metal plug. The porous plug slows down evacuation of the defroster bleed actuator to delay defroster bleed actuation for approximately one minute. When vacuum is applied to the actuator, the resulting defroster door travel is restricted to a fraction of total available travel.

The Compressor Electrical Circuit

The compressor electrical feed is from the ignition switch through the heater-A/C 25 amp fuse to the control panel circuit board switch. At the control panel circuit board the compressor is disengaged in the "VENT" and "OFF" lever settings. From the control panel the compressor circuit continues to the compressor ambient switch and on to the compressor clutch solenoid. The compressor ambient switch is mounted integrally with the ambient sensor to sense the temperature of outside air entering the system. The setting of the ambient switch is such that it opens on descending temperature by 25°F to prevent compressor operation and closes on rising temperature at 36°F ± 4°F to allow compressor operation. It should be noted that at temperatures above the ambient switch set point the compressor operates, with the ignition switch, in all control settings except "VENT" and "OFF".

Electrical and Vacuum Circuit Diagrams

In the preceding section vacuum and electrical circuits have been analyzed as they pertain to

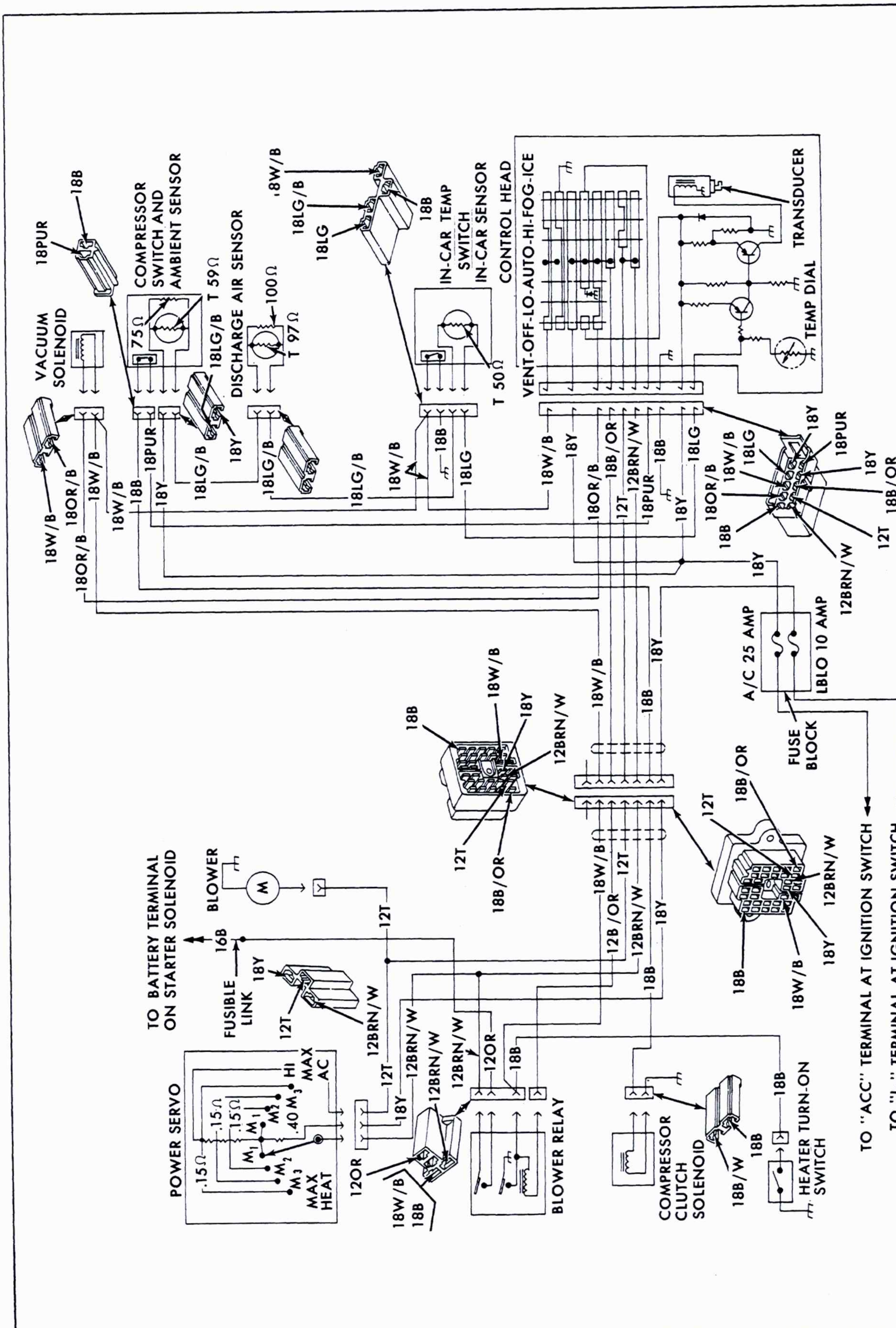


Fig. 1-25 Electrical Circuit Diagram

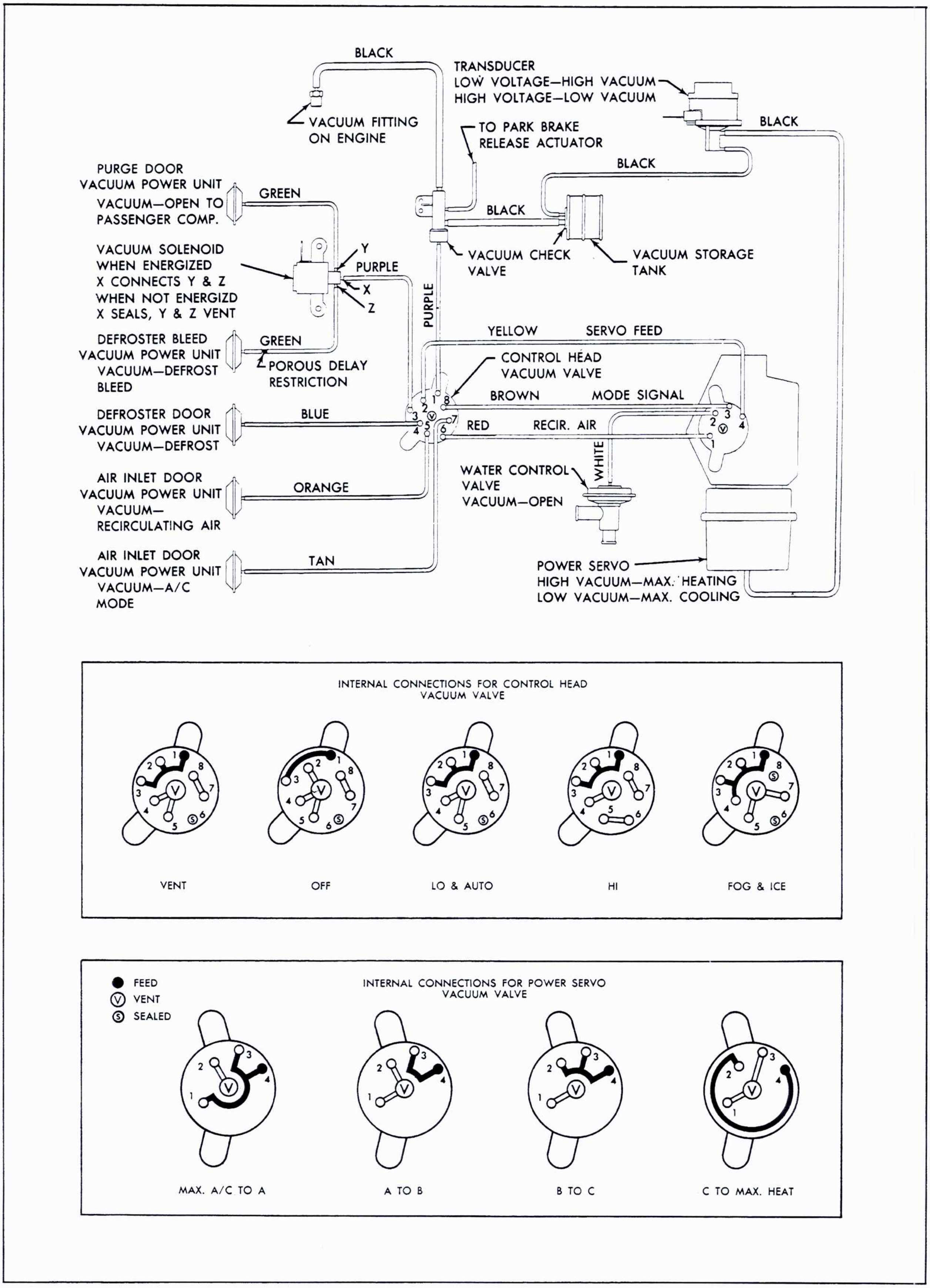


Fig. 1-26 Vacuum Schematic and Porting

individual functions. In this section the complete electrical circuit diagram and vacuum schematic are presented. A brief explanation of the use of the diagrams and a sample analysis of one lever setting at one program point will be presented.

The electrical circuit diagram is shown in Fig. 1-25; the vacuum schematic diagram and vacuum valve internal porting is shown in Fig. 1-26. The electrical and vacuum circuit diagrams are of prime importance in analyzing a system or diagnosing a problem. It is necessary to first determine the component positions in any given setting and program point. In the case of the electrical diagram place the control panel circuit board wiper arms in the lever setting to be analyzed. The in-car switch and/or heater turn-on switch should be closed if the particular analysis requires. For studies above 32° temperature the compressor ambient switch should be closed. The power servo blower circuit wiper arm may be placed in any position indicated by the complaint or study. Trace all circuit paths beginning at the ignition switch feed. If the blower relay coil is energized, trace all circuits from the starter solenoid battery feed. Verification of the car circuit to the circuit diagram will complete the analysis. Problem diagnosis as outlined in the service diagnosis section and reference to the particular system operation section will assist in analysis of problems. To use the vacuum schematic diagrams it is required to position the control lever in a particular setting and interconnect the control panel vacuum valve ports as shown on the valve internal porting diagrams (Fig. 1-26). The power servo vacuum valve ports must be connected at a particular program setting (usually maximum air conditioning or maximum heating). The solenoid vacuum valve should be energized or not energized depending on what has been determined on the electrical circuit diagram. Trace the vacuum path from the engine vacuum source through all paths. When vent is indicated, it is advisable to use a different color pencil to separate from the vacuum path. When a vacuum diaphragm is actuated, record the result. (For example - air conditioner mode, recirc air, etc.) When the diagram is complete, verify the results on the car. The individual circuits are described in the system operation section.

To clarify the use of the electrical and vacuum circuit diagrams, a sample analysis is shown in Figs. 1-27 and 1-28. The control panel circuit

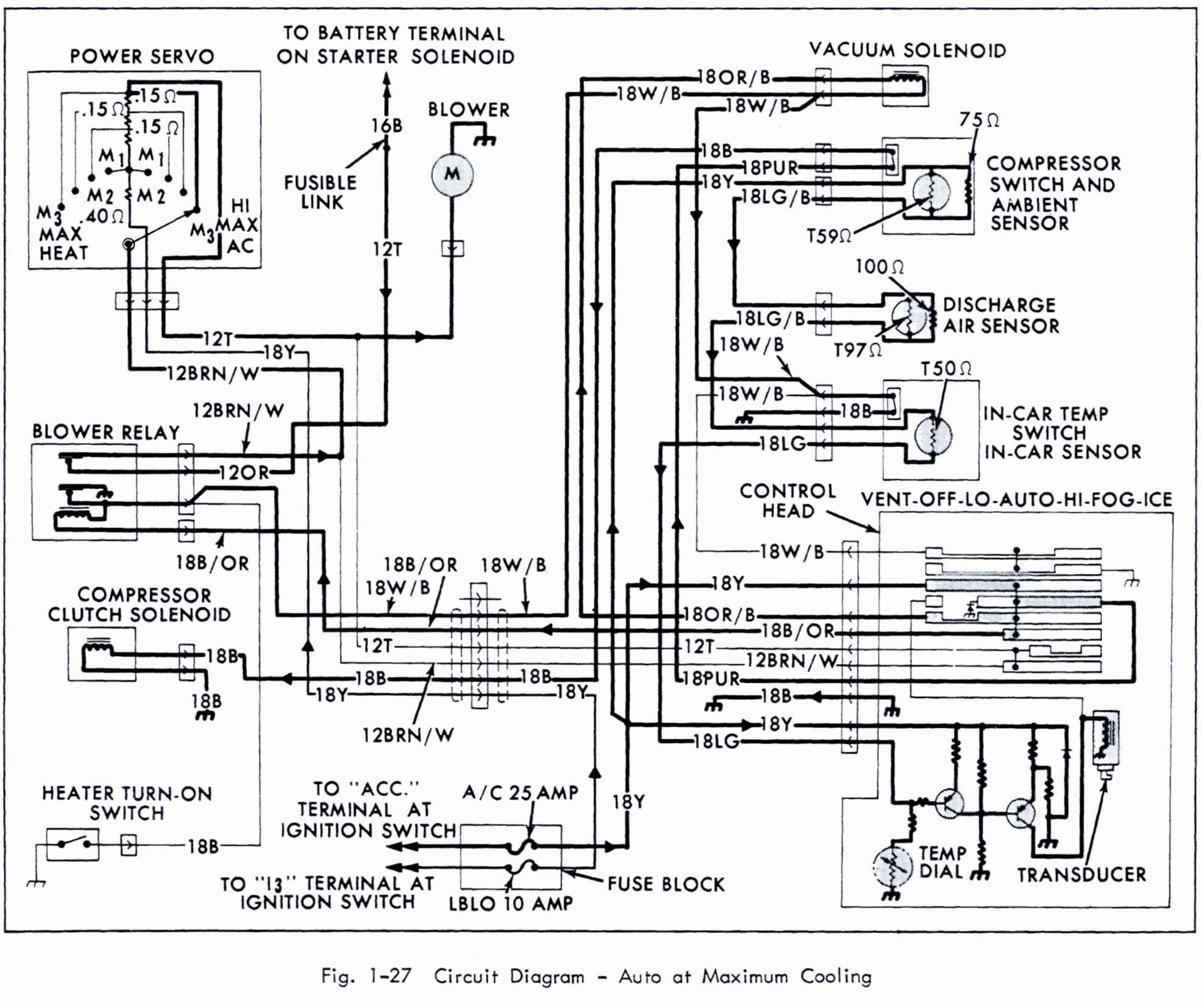


Fig. 1-27 Circuit Diagram - Auto at Maximum Cooling

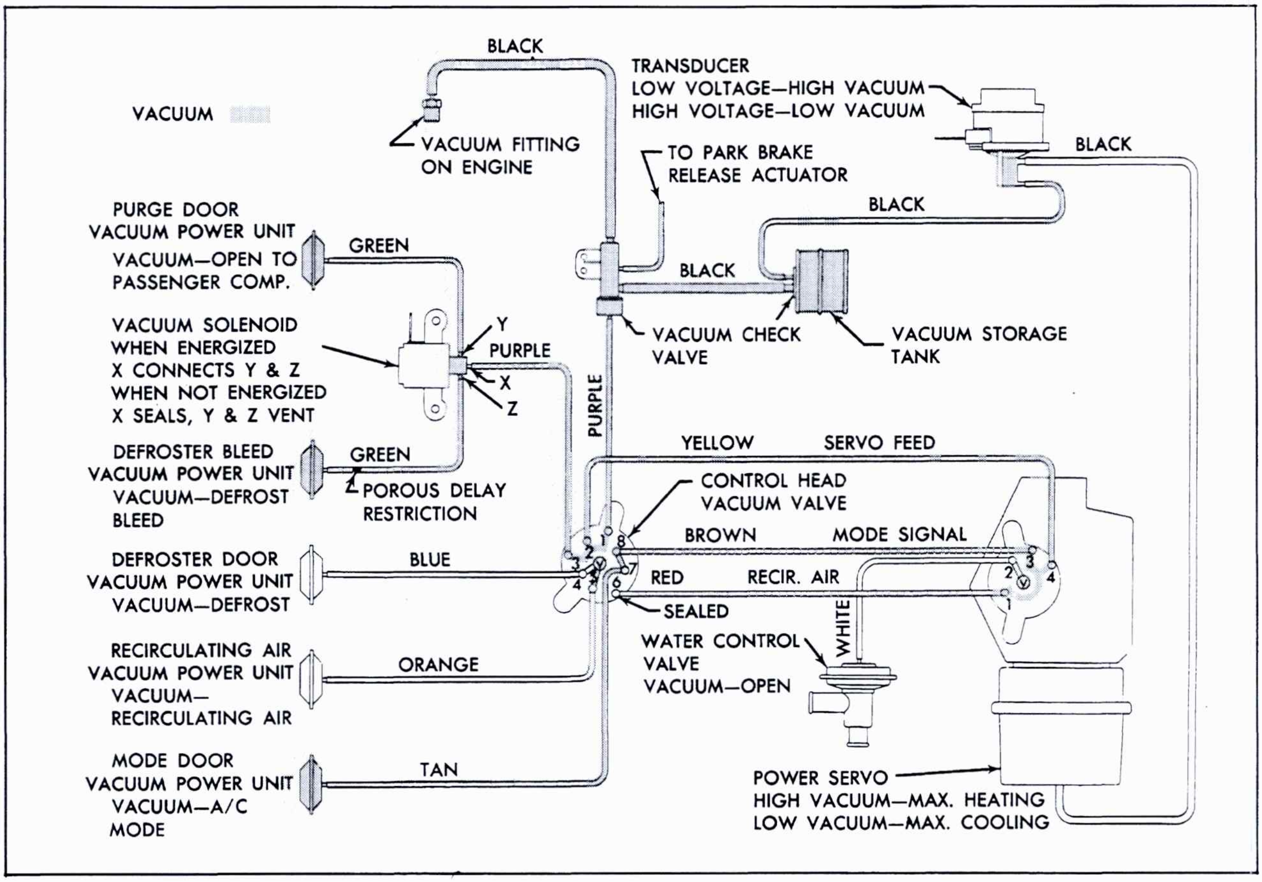


Fig. 1-28 Vacuum Schematic - Auto at Maximum Cooling

board wipers have been placed in the "Auto" setting, and the power servo is assumed to be in the maximum air conditioning position. The in-car switch is shown closed to simulate a hot weather condition compatible with the maximum air conditioning control program. The power servo blower circuit wipers are in the maximum air conditioner position for high blower speed, and the compressor ambient switch is shown closed. Note that the blower relay coil is energized to provide starter solenoid battery terminal feed to the blower circuit and that the solenoid vacuum valve coil is energized for immediate system turn-on. The compressor clutch coil circuit is also complete to provide refrigeration. Referring to the vacuum schematic diagram, the control panel vacuum valve ports are connected as shown in the internal porting diagram under the "Auto" position. The power servo vacuum valve porting is connected as shown for maximum air conditioning. Note that the solenoid vacuum valve is shown actuated to pass vacuum as determined in the electrical circuit analysis. The following results may be seen from the completed vacuum diagram:

a. The power servo diaphragm is charged for maximum air conditioning (No vacuum).

b. The air inlet door is positioned to provide 100% outside air into the system (no vacuum to the recirc door actuator).

c. The purge door is set to allow air delivery into the passenger compartment (vacuum to the purge door actuator).

d. The mode door is positioned to deliver air to the air conditioner outlets (vacuum to mode actuator).

e. The heater water valve is closed (no vacuum to water valve diaphragm).

Other lever settings and temperature control program points may be analyzed in a similar manner.

SERVICE INFORMATION

STANDARD SERVICE PROCEDURES

1. Differences in Air Conditioner Equipped Cars

Cadillac cars equipped with an air conditioner incorporate special engineering features to compensate for the extra weight, power requirements, and electrical loads demanded by the air conditioner system. The following features should be kept in mind when working on air conditioned cars.

a. Fan Assembly

A thermostatically controlled limited-slip clutch is used to reduce fan noise.

b. Radiator Assembly

A special radiator is used with additional copper tubing for better cooling.

c. Power Steering Pump Pulley

A double sheave pulley is used on air conditioned cars.

d. Fuel Filter and Vapor Return Line

A vapor return line is connected from the fuel pump to the fuel tank to reduce the possibility of vapor lock.

e. Generator

A 55 ampere generator is used to accommodate the greater electrical load.

f. Suspension

Front coil springs have higher static load rate to compensate for additional weight of the system's components (except 693).

g. Thermal Vacuum Switch

The thermal vacuum switch is used on all air conditioner equipped cars. During prolonged idling periods or in unusually warm weather, this thermostatically controlled switch increases engine rpm by actuating the idle speed-up control. It also provides a variable vacuum signal to the distributor vacuum advance unit to provide more precise spark control.

h. Idle Speed-Up Control

The idle speed-up control used on cars equipped with air conditioner increases engine rpm to improve engine cooling and air conditioner performance. Idle speed-up only occurs in Park or Neutral with high engine temperatures, and is sensed by the engine thermal vacuum switch.

i. Carburetor

The carburetor used on cars equipped with air conditioner contains mounting and actuating provisions for the idle speed-up control and a vacuum feed port for the thermal vacuum switch circuitry.

2. Handling Refrigerant and Refrigeration Components

a. Maintaining Chemical Stability

The efficient operation of the air conditioning system is dependent on the pressure-temperature relationship of pure refrigerant 12. As long as the system contains pure refrigerant 12 (plus a certain amount of refrigeration oil which mixes with the refrigerant), it is considered to be chemically stable.

When foreign materials, such as dirt, air or moisture are allowed to get into the system, they will change the pressure-temperature relationship of the refrigerant. The system will no longer operate at the proper pressures and temperatures, and the efficiency of the system will decrease.

The following general practices should be observed to insure chemical stability in the system:

1. Whenever it becomes necessary to disconnect a refrigerant connection, wipe away any dirt or oil at or near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be immediately capped or plugged to prevent the entrance of dirt, moisture, or foreign material. All air contains moisture. Air that enters any part of the system will carry moisture with it and the exposed surfaces will collect the moisture quickly.
2. Tools should be kept clean and dry. This includes the Charging Station and the Gage Set.
3. When adding oil, the container and the transfer tube through which the oil will flow should be exceptionally clean and dry in order to keep the refrigeration oil as moisture-free as possible. For this reason, the oil container should not be opened until ready for use, and should be capped immediately after use.
4. When it is necessary to open a system, have everything needed ready and handy so that as little time as possible will be required to perform the operation. Do not leave the system open any longer than is necessary.
5. Any time the system has been opened and sealed again, it must be properly evacuated, as described in Note 5c.
6. Use only refrigerant from a reputable dealer, as contaminated refrigerant will not only lower the efficiency of the system, but will damage the unit. Use only refrigerant 12 as refrigerant for the Cadillac system, since any other refrigerant will damage the compressor or other parts by incorrect pressure-temperature relationship.

b. Precautions in Handling Refrigerant

Refrigerant 12 is stored and shipped as a liquid under pressure in heavy metal drums in 10, 25, and 145 pound sizes and in 1, 12, and 25 pound disposable containers. Correctly handled, it is as safe as compressed air. Incorrectly handled, it can explode and cause serious damage.

In handling refrigerant drums, always observe the following safety precautions.

1. Do not leave drum uncapped if drum is so equipped. The metal cap furnished with the drum when it is shipped is to protect the valve in case the drum is accidentally knocked over. This eliminates the possibility of the drum flying through the shop and causing serious damage to people and property. A safety plug is provided on the valve in case the temperature exceeds the safe

limits of the drum. The cap is designed so that if the safety plug at the valve should blow, the refrigerant will escape without causing the drum to move.

2. Do not overfill drum. A safety plug is provided in case the temperature of the refrigerant exceeds the safe limits of the drum. However, if the drum is overfilled, the pressure created could cause the drum to explode before the temperature rises to the point where the safety plug would burst and allow the refrigerant to escape.

3. Do not carry the drum in the passenger compartment of a car. Always place drum in the luggage compartment of car. If a drum is carried in an open truck shield it for protection from the sun's rays. This heat could increase the pressure enough to cause safety plug to burst.

4. Do not subject drum to high temperature when charging system -- use water no warmer than 125°F to heat drum. Never place drum on steam radiator or stove, or use torches for heating during charging.

5. Do not discharge refrigerant 12 into areas where there is an exposed flame or where it could be drawn into the engine air intake when the engine is operating. Concentrations of this gas in contact with a flame may produce a poisonous gas.

6. Always wear goggles when doing work that involves opening the refrigerant lines. An accident can easily cause liquid refrigerant to strike the face. If goggles protect the eyes, the likelihood of serious injury will be reduced. A skin injury can be bathed with cold water and treated in the same manner as frostbite. If refrigerant liquid should strike the eye, proceed as follows:

a. Do not rub it in. Splash the affected area with quantities of cold water to bring the temperature gradually above the freezing point. Apply a few drops of antiseptic oil to provide a protective film.

b. If irritation continues, wash the eyes with a weak solution of boric acid.

c. Consult an eye specialist immediately for treatment.

c. Welding

Excessive heat applied to any section of the refrigerant lines will create excessively high pressures. For this reason, welding should not be performed on any portion of the car adjacent to the refrigerant units or lines.

d. Undercoating

To simplify service operations, undercoating should not be applied to any connections or rubber lines of the refrigeration system. While it is permissible to undercoat the metal refrigerant lines, all flare joints and connections should first be masked.

e. Collision Service

It is very important that the air conditioning system be inspected as soon as possible whenever a car so equipped has been involved in a collision. If the system has been opened as the result of a collision, it will permit the entry of air, moisture, and dirt that will cause internal damage. As the length of time the system has been open and the extent of damage to the components will govern the replacement of parts and the service operations required, a definite procedure cannot be recommended to cover all cases. The following, however, may be used as a guide:

1. Make certain clutch is disengaged, if car is to be operated before repairs are made.

2. Inspect all units and lines, noting any damage.

a. If condenser is damaged, it should be replaced. No repairs such as soldering, brazing or welding should be attempted.

b. Replace dehydrator-receiver assembly if damaged, leaking, clogged or restricted, or if system was open for any period of time.

3. Check compressor and clutch pulley for cracks. If compressor does not show evidence of external damage, it may be used.

f. Handling Components

1. Store all lines to avoid crushing or kinking.

2. Lines should be kept sealed and dehydrated in stock. Do not remove shipping caps from lines until just before installation.

3. Always use two wrenches when tightening fittings to prevent twisting the hoses or soft aluminum tubing. Lubricate all fittings with refrigeration oil to allow the joint to be tightened without twisting the pipe.

4. Cap ends of lines that have been disconnected for any reason, to prevent entrance of moisture or dirt.

5. Gage set and lines should be kept clean and free from moisture.

6. Do not leave refrigeration oil container open any longer than necessary, as the special oil is moisture-free, but will rapidly absorb moisture from the air.

7. Use Vacuum Pump, J-5428, or Charging Station, J-8393, to remove any air or moisture that may have entered the system when it was opened to replace a part.

g. Replacing Components

When removing any components or lines from the system, they must be capped and plugged immediately to prevent exposing them to moisture.

All components of the air conditioning system are shipped dehydrated and sealed. They are to remain sealed until just prior to making connections and should be at room temperature before uncapping to prevent condensation of moisture from the air that enters the components. They should not be uncapped any longer than necessary to make a connection.

All precautions should be taken to prevent damage to the fitting and connections. Any fittings with grease or dirt on them should be cleaned prior to assembly, using a clean cloth dipped in

alcohol. If dirt, grease or moisture gets inside lines and cannot be removed, lines may have to be replaced.

All blue O-rings for making closures for shipment should be discarded and new black O-rings used for making final refrigerant connections.

Use a small amount of refrigerant oil on all tubes and hose joints and lubricate the O-rings with this oil before assembly. Always slip the lubricated O-ring onto the flange tube to insure proper locating and sealing.

All O-ring connections should be tightened with torque wrenches and a crowfoot wrench (used at a 90° angle to the torque wrench for accurate reading,) in accordance with the table at the end of Section 1. Note that the torque specified for aluminum or copper tubing is less than that specified for steel tubing.

If a connection is made with steel to aluminum or copper, use torques for aluminum. In other words, use the lower torque specification. Use steel torques only when both ends of connection are steel.

Backing wrenches of the required size must be used during the final tightening of all O-ring and flare-type connections.

3. Maintenance and Inspection

NOTE: The following items should be checked every spring and whenever the car is brought in to check the air conditioning.

a. Functional Test of the Air Conditioner

1. See Note 8 to perform this test.

b. Sight Glass Check

Check sight glass for full charge of refrigerant. If system is low, leak test and make necessary repairs. See Note 4.

NOTE: It is normal for some foaming to occur in the sight glass with an outside air temperature of 70°F or below.

c. Leaks

If there is evidence of oil leaks, leak test entire system and make necessary repairs. See Note 6.

d. Temperature Door Adjustment

Operate system and check for an obviously incorrect temperature door setting. There should be approximately 5/32" clearance between temperature door adjusting screw and tang with vacuum hose disconnected at power servo. See Note 9a and 9b.

e. Coolant Level

Check coolant for proper level. See Section 6, Note 1.

f. Belt Tension

Check tension of belts as described in Section 6, Note 11.

g. Compressor Clutch

Observe clutch to make certain it is engaging and disengaging while moving the selector lever between OFF and LO with the engine idling.

4. Checking Refrigerant Charge

Bubbles in the sight glass do not always indicate that the system is low on refrigerant. If the system is at a control point, bubbles may appear in the sight glass even though the system is fully charged.

A certain amount of foaming is also normal with an outside air temperature of 70°F or below.

Check refrigerant charge at the sight glass and proceed as described below to make certain that system is not at bubble producing control point.

1. Connect Charging Station low pressure line to gage fitting on suction throttling valve.
2. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.
3. Run engine at 1500 rpm for 5 to 7 minutes to stabilize system.
4. Observe low pressure reading. Low pressure gage should read approximately 29 ± .5 pounds.
5. Slow down engine.
6. Maintain engine speed at this level, wait several minutes and then observe sight glass.

a. If a solid column of refrigerant appears in sight glass, it is an indication that charge in system is adequate or overcharged.

b. If bubbles appear in sight glass, it is an indication that system is low on refrigerant. Add refrigerant to system as described in Note 5e.

5. Purging, Evacuating and Charging the Refrigeration System

a. Purging Refrigerant From System

When replacing any air conditioner component, the system must be purged (drained) of refrigerant. The purpose is to lower pressure inside the system so that a component part can be safely removed. Following is a simplified procedure for purging refrigerant from system.

CAUTION: Always wear goggles when doing work that involves opening refrigerant lines.

1. Remove caps from high pressure fitting on high pressure line and gage fitting on suction throttling valve.
2. Install Gage Adapters, J-5420, on high and low pressure fittings.
3. Tighten adapters to depress valve cores until

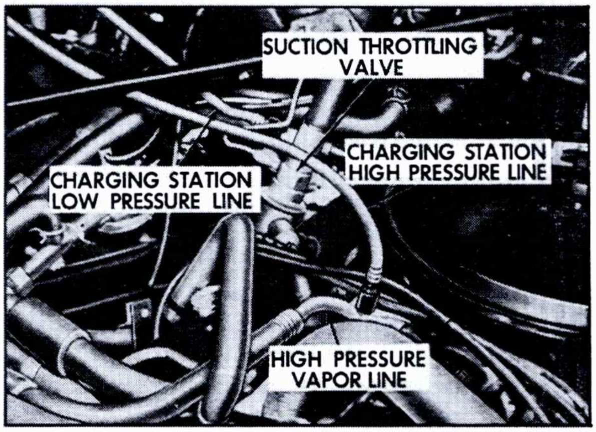


Fig. 1-29 Connecting Charging Station Lines

a hissing sound is heard, indicating that refrigerant is escaping from system at each adapter.

NOTE: Do not overtighten adapters; otherwise, oil will escape from system. Refrigerant should escape in a vaporous form. If any trace of oil is detected, loosen adapters.

b. Connecting Charging Station, J-8393

1. Remove caps from high pressure fitting on high pressure line and the gage fitting on suction throttling valve.
2. Make certain that all valves on charging station are closed.
3. Install Gage Adapters, J-5420, on Charging Station high and low pressure lines.
4. Connect charging station high pressure line to fitting on high pressure line and low pressure line to gage fitting on suction throttling valve, Fig. 1-29.

c. Evacuating System

Whenever the air conditioning system is opened for any reason, it should not be put into operation again until it has been evacuated several times. For this operation use Charging Station, J-8393, to remove air and moisture that may have entered the system.

Check Charging Station vacuum pump oil level at oil filler screw on front of pump. Oil should be level with bottom of filler tube, Fig. 1-30. Add 150 viscosity refrigeration oil to bring to proper level. Change the oil in pump every 250 hours of operation. A small amount of 150 viscosity oil may be drawn into the pump occasionally to insure protection of internal parts during periods of disuse. If the pump should fail to start, check capacitor or relay.

1. Purge system as described in part a of this note.
2. Connect Charging Station high and low pressure lines as described in part b of this note.
3. Plug in Charging Station to 110 volt outlet and turn on vacuum pump switch.
4. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 3 (vacuum control).
5. Operate to obtain 28 inches of vacuum, then continue to operate pump for ten minutes.
6. While evacuating the system, add refrigerant to cylinder on Charging Station by opening valves on refrigerant drum and at bottom of cylinder (valve 4 must be closed). Open valve on top of cylinder until proper liquid level is obtained in sight tube, and then close both top and bottom valves on cylinder.
7. Close valves 1, 2 and 3 and turn off vacuum pump switch. System should hold vacuum, unless there is a leak present.
8. Slowly open valves 2 and 4, allowing 1/2 to 1 lbs. of refrigerant to enter system, then close valves.

NOTE: It is advisable at this time to leak test system for major leaks as described in Note 6.

9. Purge system.
10. Repeat steps 4 and 5.
11. Repeat step 7.
12. System is now ready for complete charge of refrigerant as described in part d of this note.

d. Adding Refrigerant (Complete Charge)

1. Evacuate system as described in part c of this note. The system must be properly evacuated.
2. Fill cylinder on Charging Station with refrigerant as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube. (4 pounds on standard models, 5 1/4 pounds on Fleetwood Seventy-Five). Fleetwood Seventy-Five refrigerant will have to be added in two steps as required charge is greater than capacity of Charging Station cylinder.

3. Fully open valves 2 and 4 to allow refrigerant to flow into system.

NOTE: If refrigerant does not flow freely into system, it is probably due to valve cores in high pressure line and STV fittings not being depressed far enough. If this condition exists, try another Gage Adapter, J-5420, or build up an adapter depressor tongue with solder to depress valve core further.

4. After liquid refrigerant has stopped flowing into high pressure side of system, close valve 2.
5. Start engine and run at approximately 1500 rpm with shift lever in PARK position.
6. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.
7. Open valve 1 (valve 4 must also be open). This will allow refrigerant remaining in cylinder to be pulled into system.
8. Shut off engine, close all valves, disconnect

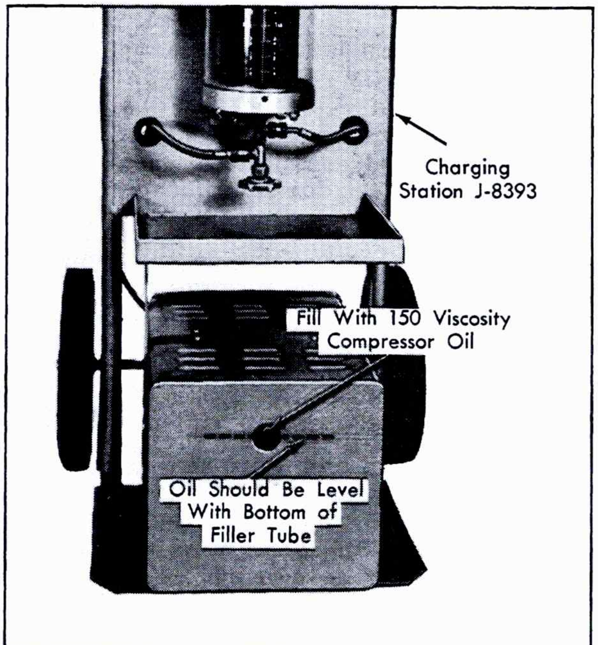


Fig. 1-30 Vacuum Pump Oil Level

Charging Station high and low pressure lines and replace caps on fittings.

9. The system should not be overcharged due to excessive head pressures that result.

e. Adding Refrigerant (Partial Charge)

Refrigerant can be added to the air conditioning system using Charging Station, J-8393. The charging lines must be purged before any refrigerant is added.

1. Connect Charging Station as described in part b of this note.

NOTE: Purge air from Charging Station high and low pressure lines before connecting. To purge lines, crack open valves 1, 2 and 4, making certain that there is some refrigerant in cylinder, then install lines and close valves.

2. Operate engine at 600 rpm with shift lever in PARK position.

3. Move Automatic Climate Control lever to AUTOMATIC position and set temperature dial to 65°F.

4. Fill cylinder on Charging Station with 2 to 3 pounds of refrigerant, as follows:

a. Open valves on refrigerant drum and bottom of cylinder (valve 4 must be closed).

b. Open valve on top of cylinder until proper liquid level is obtained in sight tube.

c. Close valve at bottom of cylinder.

5. Open valves 1 and 4. Watch sight glass until solid column of liquid appears, then close valves.

NOTE: It is normal for some foaming to occur in sight glass with an outside air temperature at 70°F or below.

6. After five minutes of operation, check sight glass again. If no bubbles appear, open valves 1 and 4 and add another 1/2 pound of refrigerant.

7. If bubbles appear, repeat steps 5 and 6.

8. Shut off engine, close all valves, disconnect Charging Station, and install gage fitting caps.

9. The system should not be overcharged due to excessive head pressures that result.

f. Adding Oil

The six-cylinder compressor uses 525 viscosity refrigeration oil. An oil charge of 10-1/2 fluid ounces is required, (13-1/2 fluid ounces on Fleetwood Seventy-Five models). It is important that only the specified type and quantity of oil be used in the compressor. If there is a surplus of oil in the system, too much oil will circulate with the refrigerant, causing the cooling capacity of the system to be reduced. Too little oil will result in poor lubrication of the compressor.

When it is necessary to replace a component of the refrigeration system, certain procedures must be followed to assure that the total oil charge in the system is correct after the new part is on the car. When the compressor is operated, oil gradually leaves the compressor and is circulated through the system with the refrigerant. Eventually a balanced condition is reached in which a certain amount of oil is retained in the compressor and a certain amount is continually circulated. If a component of the system is removed after the system has been operated, some oil will go with it. To maintain the original total oil charge, it is necessary to compensate for this by adding oil to the new rpelacement part.

The procedures for adding oil are as follows:

Compressor Only

1. Idle engine for 10 minutes at 1000 - 1500 rpm at maximum cooling and high blower speed to allow oil to distribute itself in system in a normal manner.

2. Remove compressor from car and place it in a horizontal position with drain plug downward. Drain oil, measure, and discard it.

3. Drain oil from compressor that is to be installed in car.

4. If oil drained in step 2 is more than 4 fluid ounces, add to new compressor the same amount of oil as drained from replaced unit.

5. If the oil drained in step 2 is less than 4 fluid ounces, add 6 ounces of oil to new compressor.

Replacing Components

Whenever replacing a component of the air conditioning system, measured quantities of 525 viscosity refrigeration oil should be added to the component to assure that total oil charge in system is correct before unit is operated.

Oil should be added to replacement components as indicated below.

Evaporator (front or rear)	Add 3 fluid ozs.
Condenser	Add 1 fluid oz.
Receiver	Add 1 fluid oz.
Condenser and Receiver Assembly	Add 2 fluid ozs.

Oil should be poured directly into the replacement component. If an evaporator is installed, pour oil into inlet pipe with pipe held vertically so oil will drain into core.

If any other components, such as valves or hoses are replaced, no additional oil is necessary.

Compressor and Components

NOTE: If system has been operated and there is evidence of a major loss of oil, system has probably lost all or most of its refrigerant. If any refrigerant remains, discharge it from system. Do not operate compressor any more than is absolutely necessary to avoid damage from lack of oil.

1. Remove compressor and place in a horizontal position with drain plug downward. Drain oil from compressor, measure it and then discard it.

To promote draining, have suction connector open and tilt compressor as required.

2. Replace damaged component from which the oil was lost.
3. If more than 4 fluid ounces of oil was drained from compressor in step 1, add same amount of new oil to compressor, plus an amount to compensate for that in damaged component, as shown in the table.
4. If less than 4 fluid ounces of oil was drained from compressor in step 1, add 6 fluid ounces of oil, plus amount shown in the table for component being replaced.

6. Leak Testing Refrigeration System

There are two methods that may be used for detecting leaks in the air conditioning system. The use of a leak detector fluid or a torch type leak detector is recommended.

a. Leak Detector Fluid

Leak detector fluid (mixed with water per directions on bottle) may be used by daubing or squirting the liquid around joints to be tested. Ordinary leaks will form a cluster of bubbles almost immediately. Extremely small leaks will form a white foam which will materialize with a time limit from a few seconds to a minute, depending on size of leak.

In order to locate leaks with this fluid, it is essential that you see all of the surfaces you are checking with a good light; otherwise small leaks could easily be overlooked.

b. Torch Type Leak Detector

Detecting a leak with the torch type detector is accomplished by observing the color of the flame in the head of the detector, when the sampling tube is close to a refrigerant leak.

The flame can be described as three different colors: green, blue, and purple. Green indicates a small leak, blue indicates a medium leak and purple indicates a large leak.

CAUTION: When leak testing, avoid inhaling fumes or gas from detector torch. They may be toxic and cause damage to the lungs if inhaled. It is also recommended that a fire extinguisher be close at hand when using the leak detector torch.

To operate unit, open valve until a low hiss of gas is heard, then light the flame at opening in detector chimney. Adjust flame until blue flame is approximately 3/8 inches above reaction plate to make detector as sensitive as possible for small leaks.

When checking for leaks, always position sampling tube below fitting or area to be tested, as refrigerant 12 is a heavy vapor and will sink when exposed to air.

It is best to test low pressure side of system at drum pressure which is much higher than normal low side operating pressure.

In testing high pressure side for leaks, run system for a few minutes to build up pressure in high pressure side of system. Then stop engine and test high pressure side of system for leaks.

Do not attempt to leak test with the engine running in a drafty location as it will disperse the refrigerant 12 and be impossible to locate a leak.

7. Cooling Capacity Performance Test

NOTE: The following procedures pertain to all models except Fleetwood Seventy-Five. Performance Tests for the Fleetwood Seventy-Five Air Conditioning Systems are explained in Note 54.

a. Performing Test

1. Connect gage set high and low pressure lines.
2. Hook up tachometer.
3. Disconnect vacuum hose to power servo diaphragm and plug hose.
4. Locate auxiliary fan 24" in front of condenser (12" in front of grille).
5. Place humidicator, J-6076, in auxiliary fan air stream in front of car.
6. Open both front doors.
7. Open all A/C outlets.
8. Insert a calibrated thermometer in right-hand outlet.

CAUTION: Sensing bulb should not touch metal or plastic.

9. Set A/C control lever to "Auto".

10. Place shift lever in "Park" and apply parking brake.

11. Start engine and set to run at 2,000 RPM.

12. Lower hood carefully to lowest position possible. Do not pinch or damage gage set hoses.

13. Allow engine to run for 10 minutes.

14. Record readings of:

a. Ambient dry bulb, which gives the temperature in front of the condenser.

b. Ambient wet bulb, which determines the humidity.

c. High and low side pressures.

d. Air temperature at right hand outlet.

b. A/C Test Conclusions

The discharge temperature should agree with the value shown on the Discharge Air Temperature Chart, left side of Fig. 1-31, within ± 3°F.

The high pressure should agree with the value shown on the High Side Pressure Chart within 25 psi, right side of Fig. 1-31.

The low side pressure should be 29 psig ± 2 psig in all cases, except where ambient temperature and humidity are extremely high.

If these conditions are not met, refer to the diagnosis section.

8. Control System Functional Test

NOTE: The following procedure is used to assure correct functional operation and requires approximately two minutes to perform. The system is to be tested at room temperature with the hood down, the doors and windows closed and the engine operating. Engine coolant must be warm. Proceed as follows:

1. OPERATE CAR AT 1000 RPM OR BETTER.

2. PLACE A/C OUTLETS IN WIDE-OPEN POSITION.

3. INSTALL THERMOMETER IN CENTER A/C OUTLET.

4. SET LEVER AT ICE AND TEMPERATURE DIAL AT 85°.

a. Hot air must come out both defroster outlets.

b. Blower must operate at high speed.

5. SET LEVER AT FOG and TEMPERATURE DIAL AT 75°.

a. Cooler air must come out defroster outlets.

b. Blower must operate at lower speed.

6. SET LEVER AT HI AND TEMPERATURE DIAL AT 65°.

a. Cold air must come out A/C outlets.

b. Air inlet door in right shroud must be open (will be slightly noisy).

7. SET LEVER AT AUTO. & TEMP. DIAL TO 85°.

a. Air must shift from A/C outlets to heater outlet.

b. At same time blower speed must change. The speed will first decrease and then increase.

8. SET LEVER AT LO.

a. Blower speed must be at low.

9. SET LEVER AT OFF.

a. All airflow must cease.

10. SET LEVER AT VENT.

a. Air must come out A/C outlets.

b. Blower must operate at low speed.

9. Component Adjustments

a. Tailoring the Temperature Door Link Adjustment

If the owner complains that air temperature at which system changes modes is either too warm or too cool, turn the adjusting screw located near the power servo clockwise to increase the temperature or counterclockwise to decrease the temperature. However, do not turn adjusting screw more than one turn at a time.

b. Temperature Door Link Initial Adjustment

The temperature door link is adjusted at the factory and ordinarly will only need to be tailored

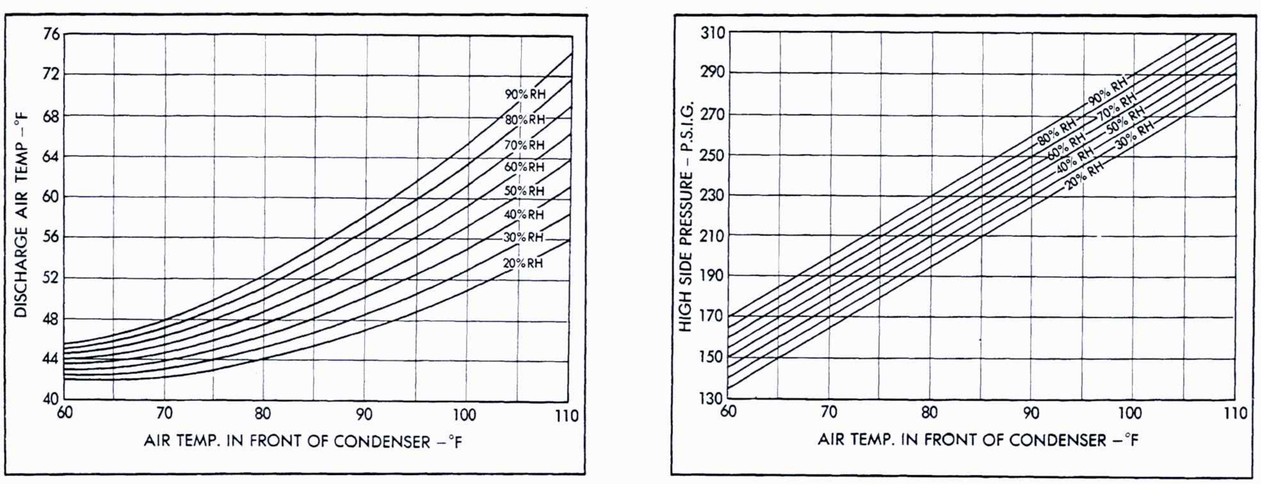


Fig. 1-31 A/C Performance Chart (Except 697)

to owner preference as described in part a of this note, should a complaint be received. However, should components that affect this adjustment be replaced, then the initial temperature door link adjustment should be performed as follows:

1. Adjust screw so there is 5/32" clearance between adjusting screw and tang with black vacuum hose disconnected at power servo diaphragm.

c. Temperature Dial Adjustment

1. Using masking tape, suspend an accurate thermometer from headliner so that bulb hangs at breath level over front passenger's seat.
2. Position auxiliary fan (approximately 24 inch diameter blades) so that air stream is directed across cowl air intake grille.
3. Close all doors and windows.
4. Set dial for comfort or desired temperature.
5. Insert Temperature Dial Adjuster, J-21530, between dial and control panel face, Fig. 1-32. While holding the gear in position, rotate the dial until the dial reading corresponds to the thermometer reading.

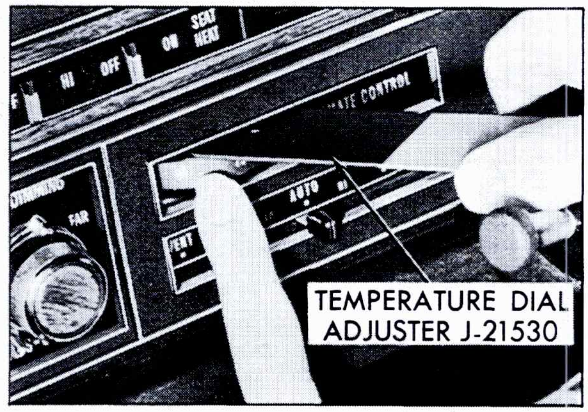


Fig. 1-32 Adjusting Front Temperature Dial

d. Compressor Drive Belts

The compressor drive belts are adjusted at the power steering pump. Follow procedure described in Section 6, Note 11.

DIAGNOSIS OF AIR CONDITIONER PROBLEMS

To diagnose an air conditioner problem in the shortest time and with the least effort, it is essential to follow a logical service procedure. The most efficient procedure is as follows:

STEP 1. Attempt to get an accurate description of the owner's complaint, in writing on the repair order, if possible.

STEP 2. Make a very brief check of system operation by sitting in the car and operating the controls, with the engine running, as follows:

Control Setting	System should Operate as Follows:
VENT	Immediate air delivery out of A/C outlets at fixed low blower -- no cooling or heating.
OFF	No air delivery into the car.
LO	Air delivery at fixed low blower -- air temperature depends on dial setting.
AUTO	Blower speeds and air temperature change as dial is rotated from 85° to 65° and air delivery shifts from heater to A/C. Discharge air should drop to 50°F. or less.
HI	Same operation as at AUTO except blower operates at fixed high speed. At Max. A/C recirc. air is used.
FOG	Air delivery from defroster outlets at all dial settings. Blower speed and air temperature vary as at AUTO.
ICE	Same as FOG except fixed high blower.

STEP 3. A simple, visual inspection of the easily-accessible underhood and instrument panel electrical and vacuum connections will, in many instances, reveal the defect on the spot. The following three areas should be checked:

1. Underhood - vacuum and electrical connections in area of power servo.
2. At mode selector assembly.
3. At control panel.

STEP 4. Try to relate the problem to one of the following areas:

1. TEMPERATURE CONTROL PROBLEMS
2. SYSTEM TURN-ON PROBLEMS
3. BLOWER SPEED CONTROL PROBLEMS
4. AUXILIARY VACUUM PROBLEMS
5. REFRIGERATION PROBLEMS

Diagnosis charts to cover each of the above areas are included in following sections.

It is of special importance to be familiar with the general description of the major sections of the system as presented in the System Operation section starting on Page 1-14.

STEP 5. In many cases, servicing of the automatic temperature control system results in replacement of electronic components that are eventually proven to be good parts. It is important to locate the exact defect; random replacement of parts is not good service procedure and, in most cases, does not solve the problem. Component substitution, however, can be used effectively to reduce diagnosis time. The following major components readily lend themselves to temporary substitution, without actually installing the substitute part:

1. Control Panel Assembly - May be substituted without removing lower steering column cover -- provides a check of the amplifier, dial rheostat,

transducer, vacuum valve and circuit board switch. The transducer, rheostat and vacuum valve can also be substituted separately without too much difficulty.

2. Power Servo Assembly - Connect the vacuum hoses and the three-way electrical connector to the substitute part.

3. Solenoid Vacuum Valve

A/C Harness Adapter, J-23189, is available and may be substituted for the entire sensor string. It is simply a 135 ohm resistor which is the equivalent of all the sensors at room temperature. It is inserted between the control head ten-way connector and the wiring harness.

STEP 6. After the problem has been properly diagnosed and the repair made, it is important to run through the brief check listed in Step 2, to insure that the system is now performing correctly. The importance of first determining the problem area in STEP 4 cannot be emphasized too strongly.

Temperature Control Problem Diagnosis

The temperature control circuit consists of the components shown in Fig. 1-33. The primary function of the temperature control circuit is to determine the correct temperature of the air to be discharged into the passenger compartment. The signal used for this purpose (vacuum to position the power servo) is also used in the blower speed control circuit and the auxiliary vacuum function circuit. Those uses may be disregarded when dealing with problems which relate only to the temperature control circuit. Examples of temperature control problems are: "System operates only at maximum air conditioning or only at maximum heating", "Temperature dial will not provide comfort", "Poor heating or poor cooling". Blower cycling and mode cycling are also caused by a malfunction in the temperature control circuit. Refer to the Control System Operation section for a brief, detailed explanation of how the circuit operates.

It will aid diagnosis to be aware of the following

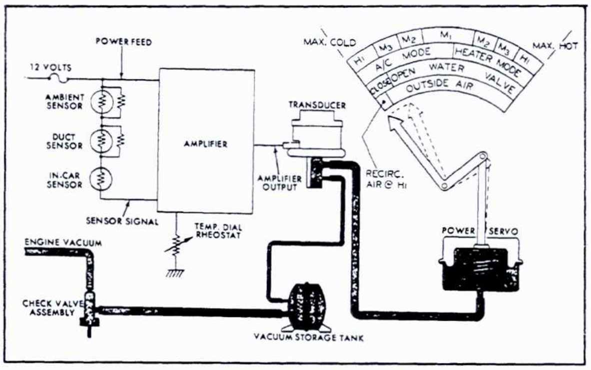


Fig. 1-33 Temperature Control Circuit

component relationships: (high temperature - low sensor string resistance - high amplifier output voltage - low transducer output vacuum - maximum cooling.) (Low temperature - high sensor string resistance - low amplifier output voltage - high transducer output vacuum - maximum heating).

Many temperature control problems result from poor electrical or vacuum hose connections; therefore, the best attack is to look for obvious disconnects. Study of the circuit shows that:

- A disconnected sensor interrupts the electrical signal and drives the servo program to maximum heating.
- A poor sensor connection adds resistance to the sensor string driving the system hotter.
- A disconnected temperature dial increases the signal in and drives the system to maximum air conditioning.
- An open amplifier power feed eliminates the output signal and drives the servo to maximum heat.
- A disconnected transducer lead interrupts the electrical signal and drives the servo to maximum heat.
- A disconnected vacuum hose in the vacuum circuit that moves the power servo will force the system to maximum air conditioning.

Problems and probable causes are as follows:

SYSTEM OPERATES ONLY AT MAXIMUM AIR CONDITIONER

This can be a vacuum or an electrical problem. With system operating, turn off ignition switch and observe power servo movement. If power servo arm remains in maximum air conditioner position, the problem is vacuum in nature. Possible defects are:

1. Disconnected or kinked hose in black vacuum lines from vacuum check valve to vacuum tank to multiple vacuum connector to transducer to power servo.
2. Defective transducer.
3. Leaking power servo diaphragm.

If power servo moves to maximum heater position when ignition is turned off, the problem is electrical in nature. Possible defects are:

1. Temperature dial disconnected or defective.
2. Defective amplifier.
3. Shorted sensor.

It is recommended that the component substitution method described in the diagnosis technique section of the introduction be used to locate defective part.

SYSTEM OPERATES ONLY AT MAXIMUM HEATER

This is usually an electrical problem. To test the system, move the control lever to the "VENT" setting. If the system now overrides to the air conditioner outlets, the transducer, transducer connector, and vacuum system are operating properly. The defect must be in one of the following areas:

1. Open circuit in harness of sensor string.
2. Open circuit in amplifier or amplifier feed to transducer.

To check for the above, dial 65° and remove steering column cover and probe the three solder points on the right hand side of the amplfier with a voltmeter. The solder point toward the front of car (yellow wire) should register approximately 12 volts. (Amplifier power feed.) If no voltage registers, there is an open circuit in the amplifier feed - 18 gage yellow wire. If approximately 12 volts does register at power feed solder point, probe the amplifier output solder point toward the rear of car (black/white wire). If 8 volts or more registers, there is an open circuit in the wire from the amplifier output to the transducer. If no voltage registers at amplifier output solder point, install A/C harness adapter J-23189 at control panel 10-way electrical connector. If the system now operates properly, there is an open sensor or open in the sensor string circuit. If the sytem continues to malfunction, the amplifier is defective.

If the system does not go to the air conditioner outlets with lever in "VENT", the fault lies in the following area:

1. Transducer electrical connector disconnected.
2. Defective transducer.

SYSTEM FLUCTUATES BLOWER SPEEDS AND MODE SHIFTS WHEN CAR IS ACCELERATED

1. Defective vacuum tank check valve.

DIAL SETTING DOES NOT PROVIDE COMFORT

If moving the dial from 65° to 85° does not provide the expected program range, it is possible that either the dial, amplifier or transducer are miscalibrated. To check the calibration of these units, remove the steering column cover, install the service tool, A/C Harness Adapter, J-23189, and perform the following steps:

1. Set the temperature dial to 75° (at center of dial opening).
2. Insert good vacuum gage at either transducer output hose (larger hose) or at power servo diaphragm. With engine idling the vacuum level should be 4.4 to 6.4 inches of mercury. If vacuum is outside of these limits, it will be necessary to check the amplifier voltage:
3. Probe the solder point toward the rear of car (black/white wire) on the right hand end of the amplifier (amplifier output) with a voltmeter. The voltage should read 5.5 to 6.5 volts. If voltage is outside these limits, rotate temperature dial until proper voltage is obtained.
4. Recheck transducer vacuum with proper amplifier output voltage; replace if defective.
5. Adjust temperature dial to read 75° when amplifier output is 5.5 to 6.5 volts. See Fig. 1-32.

BLOWER CYCLING AND MODE CYCLING

Erratic system performance may be caused by poor electrical connections, "cold" solder joints or defective sensors. The problem may be intermittent and occur from the shock of going over road bumps. To isolate the problem area, remove the steering column cover and attach a good voltmeter to the amplifier output solder point at the right hand end of the amplifier -- rearmost point in car -- black/white wire. "Rap" the areas around the sensors and amplifier and shake wires. Watch voltmeter for violent, erratic voltage fluctuations. Replacement of parts or resoldering of terminals may be necessary. Sensors may be individually checked to the sensor resistance curve. Fig. 1-13.

NOTE: System cycling may also occur and is normal if the temperature dial is moved in large increments. Instruct owner of this and explain system operation.

INSUFFICIENT HEATING OR COOLING

This problem may be caused by control system malfunction or by the refrigerant or heater systems. A quick check will determine which area to pursue.

1. Check for compressor clutch actuation (no cooling).
2. Check heater hose temperature by feel with engine hot to see if water is entering the heater core (no heating).
3. Rotate the dial from 65° to 85° -- check to see if power servo reaches both extremes of travel. If servo reaches extremes of travel, discharge air temperature at 65° dial should drop below 50°F. If it does not, refer to refrigeration diagnosis section. If the discharge air temperature does drop below 50°F. or if the power servo does not reach full extremes of travel, analyze problem as outlined in preceding articles.

System Turn-On Problem Diagnosis

The components and electrical and vacuum circuits that make up the turn-on system are shown in Fig. 1-34. System turn-on is accomplished when the purge door is moved to a position to direct air flow into the passenger compartment. Blower speed problems and "no blower" problems are separated from this section to simplify problem diagnosis and aid system understanding. System turn-on (purge door actuation) is controlled by the solenoid vacuum valve which is in turn energized through one of three grounding switch paths to cause the three, correct, manners of system turn-on:

1. Delayed turn-on in cold weather (heater turn-on switch).
2. Immediate air conditioner turn-on in hot weather (in-car switch).

Fig. 1-34 System Turn-On Circuit

3. Immediate turn-on in "VENT", "FOG" or "ICE" (Vent-Fog-Ice override switch).

Refer to the Control System Operation section for a brief, detailed explanation of circuit operation.

A simple technique may be followed to separate system turn-on problems from "No Blower" problems. With a warmed up engine, make the following observations:

Perform control panel functional test listed in step 2 of the diagnosis section introduction. If at each lever setting, air is delivered at the proper blower speed either into the passenger compartment or into the engine compartment through the purge air opening, the problem is one of system turn-on. If the blower does not operate or operates incorrectly at any lever setting, it is a blower speed control problem.

> NOTE: The blower continues to operate in the "Off" lever setting with no air flow into the passenger compartment for the purpose of removing moisture from the evaporator core when the air conditioner is not in use. Moisture-laden air is discharged into the engine compartment through the purge air opening.

Observations made during the brief Control System Functional Test (described in Note 8) should lead the serviceman quickly to the malfunctioning circuit. Problem descriptions and probable causes are listed in the following Diagnosis Chart:

NO AIR DELIVERY IN ANY LEVER SETTING

1. Blown or defective 25 amp HTR-A/C fuse.
2. Electrical disconnect at solenoid vacuum valve.
3. Electrical disconnect at control panel 10-way connector.
4. Disconnected or kinked vacuum hose in vacuum lines from check valve to multiple connector to control panel vacuum valve to solenoid vacuum valve to purge door actuator.
5. Defective solenoid vacuum valve - check by temporarily substituting a known good solenoid valve. (Drop fuse block and remove defroster hose for access to solenoid valve on mode selector case).
6. If problem persists, refer to electrical circuit diagrams for wiring continuity.

NO HEATER TURN-ON IN COLD WEATHER EXCEPT IN VENT, FOG, OR ICE

NOTE: If problem does not occur in garage, it is probable that system is turned on by in-car switch. Remove heater turn-on switch and check cold.

1. Black wire not connected to heater turn-on switch (located at front of right hand cylinder head).
2. Defective heater turn-on switch (won't close) - check by grounding switch feed wire.
3. If problem persists, refer to electrical circuit diagrams for wiring continuity.

IMMEDIATE HEATER TURN-ON IN COLD WEATHER

1. Defective (closed) heater turn-on switch (check cold).
2. Defective solenoid vacuum valve. (Check by putting control lever to "OFF" with engine running. If system continues to operate at low blower, solenoid valve is defective. If system shuts off, solenoid valve is functioning.
3. Defective (closed) in-car switch.
4. If problem persists, refer to electrical circuit diagram for wiring continuity.

AIR CONDITIONER DOES NOT TURN ON IN HOT WEATHER UNTIL ENGINE WARMS UP

(or unless control lever is in "VENT", "FOG", or "ICE")

1. Defective (open) in-car switch - check by removing small grille on instrument panel upper cover and shorting across switch terminals. (White/black and black wires).
2. Electrical disconnect at in-car switch -- will probably also disconnect in-car sensor which sends the system to maximum heat.
3. If problem persists, check wiring continuity by referring to the electrical circuit diagram.

Blower Speed Control Problem Diagnosis

Three separate electrical circuit paths are provided for blower speed control as follows:

VENT, OFF, LO - through I_3 terminal of ignition switch, to 10 amp LoBlo fuse in fuse block, through all four resistors on the power servo circuit board, and to the blower motor providing only fixed low blower speed.

AUTO, FOG - with blower relay coil energized, the electrical feed path is from the starter solenoid battery terminal to the power servo circuit board where circuit paths through and around three resistors are programmed automatically to obtain four blower speeds.

HI, ICE - same feed path as used in "AUTO" and "FOG" except that a circuit path is provided in the control panel circuit board to bypass the servo resistors, providing only fixed high blower speed.

Refer to Fig. 1-35 for circuits and components. Refer to Control System Operation section for a brief, detailed explanation of how the circuit operates.

It is often necessary to separate blower speed control problems from system turn-on problems. If air is delivered in all lever settings, as described above, either into the passenger compartment or through the purge air opening into the engine compartment, it is a system turn-on problem - refer to that section. If air delivery speed is discontinuous or does not agree with description above, it is a blower speed control problem. Check for air delivery into the engine compartment at the purge air opening located at the bottom left hand side of the heater case.

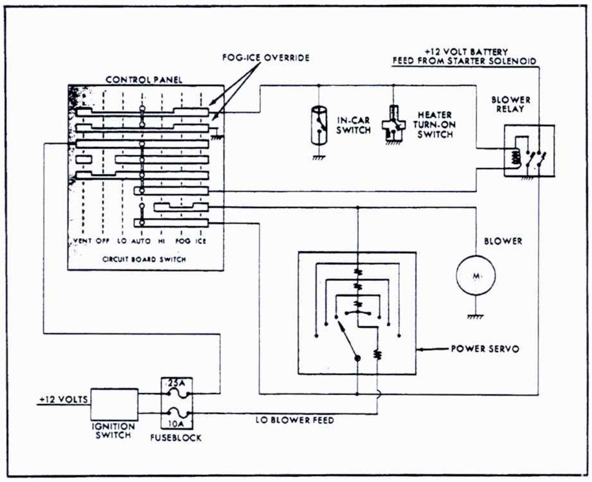


Fig. 1-35 Blower Speed Control Circuit

SYSTEM OPERATES ONLY AT LOW BLOWER

1. Electrical disconnect at blower relay.
2. Open in fusible link (horn and window motor will not operate).
3. Defective relay - temporarily by-pass or use substitute relay.
4. Open in relay coil feed or ground circuit.
5. Blown or defective 25 amp Htr-A/C fuse. This condition will also prevent actuation of the purge door. Refer to turn-on problem section.

NO BLOWER IN ANY LEVER SETTING

1. Electrical disconnect at blower motor.
2. No blower ground.
3. Stalled blower motor.
4. Open circuit in wiring harness to blower motor.

NO BLOWER IN VENT, OFF, OR LO

1. Blown or defective 10 amp LoBlo fuse.
2. Open low speed resistor - temporarily substitute servo.
3. Open circuit in wiring harness - Refer to circuit diagram.

OPERATES AT FIXED LOW BLOWER EXCEPT IN HI AND ICE

1. Open circuit in wiring harness - refer to circuit diagram.
2. Defect in power servo wiper contact - temporarily substitute known good power servo.

BLOWER OPERATION ONLY IN HI AND ICE

1. Electrical disconnect at power servo - check for by-passed terminals when connector is reinstalled.

BLOWER SPEED VARIES IN HI AND ICE

1. Defective wipers in control panel circuit board switch.
2. Open in by-pass circuit in wiring harness - Refer to electrical circuit diagram.

BLOWER OPERATES WITH IGNITION OFF

1. Defective blower relay (closed contacts)

Auxiliary Vacuum Problem Diagnosis

Auxiliary vacuum functions are defined as those circuits in the automatic temperature control system which do not affect the temperature of discharge air, the delivery of air into the passenger compartment, or control of blower speed. Included in this section is one auxiliary electrical circuit, the compressor actuation circuit. A list of the auxiliary circuits is as follows:

1. Defroster door vacuum circuit
2. Recirc door vacuum circuit
3. Mode door vacuum circuit
4. Heater water valve vacuum circuit
5. Defroster bleed vacuum circuit
6. Compressor electrical circuit

Refer to the Control System Operation section for a brief explanation of each function and separated circuit diagrams.

Because of the relative simplicity of each of the auxiliary vacuum circuits, the best diagnostic aid will be a clear understanding of the type of problem or complaint which would result from a malfunction in any of the individual circuits. Once the problem has been isolated to a specific circuit, diagnosis will generally consist of checking vacuum connections at one or two points. Following are the types of problems most likely to be encountered in each of the auxiliary circuits:

DEFROSTER DOOR ACTUATION PROBLEMS

1. The most usual problem to be expected in this circuit would be ''system does not discharge air out of the defroster outlets.'' Vacuum to the defroster actuator is required for defroster operation. Check hose connection (blue) at defroster actuator.
2. If system stays in air conditioner, check vacuum circuit to determine why mode override did not occur.

RECIRC AIR DOOR ACTUATION PROBLEMS

1. The most likely problem to be encountered will be "No recirc air in Hi setting." Vacuum is required to obtain recirc air. Check hose connection at recirc air door.

2. If recirc air operation occurs at other than maximum A/C in "Hi", check vacuum hose colors against vacuum circuit diagram.

MODE DOOR ACTUATION PROBLEMS

1. The most likely malfunction would be "No air conditioner operation." Discharge air temperature change and blower speed changes occur, but only in the heater mode. Vacuum is required for air conditioner mode. Check vacuum hose connection at mode diaphragm.

2. If system operates only from air conditioner outlets, check for vacuum at diaphragm. No vacuum - stuck door. Vacuum - check hoses for pinched hoses or misconnects.

HEATER WATER VALVE CONTROL PROBLEMS

The heater water valve is a normally-closed valve requiring vacuum to open and flow water. A malfunction in this circuit will probably result in complaints of "No heat" in winter and "Too cold" in mild weather. Check the vacuum hose connections at the water valve and at the power servo vacuum valve.

DEFROSTER BLEED PROBLEMS

Actuation of the defroster bleed vacuum diaphragm is delayed by a porous flow plug inserted in the green-coded vacuum hose at the defroster bleed diaphragm. Complaints relating to defroster bleed operation will generally be of two types:

1. No defroster bleed. Check hose connections at defroster bleed actuator and at solenoid vacuum valve; if connections are all right, porous plug is too restrictive - replace.

2. Rapid fogging of windshield when heater turns on. Either no porous flow plug or defective porous flow plug.

COMPRESSOR ELECTRICAL PROBLEMS

Malfunctions in the compressor electrical circuit would result in complaints of "no cooling" or "insufficient cooling". Perform the following checks:

1. Electrical disconnect at compressor clutch coil.
2. Electrical disconnect at compressor ambient switch.
3. Defective compressor ambient switch.
4. Open in wiring harness - refer to circuit diagram.

Refrigeration Problem Diagnosis

The sole function of the refrigeration system is to maintain the evaporator core cooling surfaces at 32°F. when refrigeration is required. A properly-operating refrigeration system will do this, if engine speed is sufficient and the heat load on the system is not excessive. A refrigeration problem exists when there is a defect in one of the refrigeration components or in the overall system which interferes with this function. In most cases, the defect will result in higher-than-normal core temperature and loss of effective cooling; in a few specific cases the core will operate at a temperature lower than 32°F. and condensate in the core will freeze and block air-flow, again causing a loss of cooling.

It is important to separate refrigeration problems from temperature control problems. This can be done simply during the brief lever setting check prescribed at the beginning of the diagnosis section. Proceed as follows:

1. Set lever at VENT-OFF-LO-AUTO-HI-FOG-ICE and check for proper system operation, as described earlier.

2. If system operates properly, return lever to AUTO and set dial at 65°.

3. Install thermometer in center air conditioner outlet. Wait approximately one minute. Thermometer should read 45° to 50° unless temperature or humidity of test area are excessively high.

4. If the discharge temperature is significantly higher than 50°, disconnect and plug the large diameter vacuum hose attached to the power servo diaphragm. . Check to assure that the air-mix door crank-arm is pivoted fully toward the right side of car.

5. If the discharge air temperature drops to 50° or below as a result of disconnecting the power servo hose, the problem belongs in the Temperature Control category.

6. If the temperature does not change and is still significantly higher than 50°, a refrigeration problem exists.

Many refrigeration problems can be readily diagnosed without connecting the refrigeration gage set or performing the more extensive Cooling Capacity Performance Test listed in the standard service procedures. Defects causing problems of this sort are listed in the chart that follows:

NO REFRIGERATION OR INSUFFICIENT REFRIGERATION

Gage set usage not required for diagnosis.

1. No voltage to compressor clutch -
   Check compressor electrical circuit, including compressor ambient switch.
2. Compressor seized - clutch plate slips -
   Clutch plate moves rearward and engages pulley but pulley cannot drive it.
3. Compressor belts slipping.
4. No refrigerant in system -
   If sight glass is clear and suction line at compressor is not cold and there is very little or no refrigeration, the system refrigerant charge probably has been lost.
5. Insufficient refrigerant in system -
   Indicated by foam in sight glass - see standard service procedure.

The following chart lists defects that usually require connecting the gage set and running the Cooling Capacity Performance Test.

NO REFRIGERATION OR INSUFFICIENT REFRIGERATION

Gage set usage and cooling capacity performance test required

If discharge air temperature and evaporator pressure recorded during test were both high, one of the following defects is probably responsible:

1. STV is defective - maintains evaporator pressure higher than 29 psi. -
   Usually characterized by cold suction pipe at inlet of valve and very cold pipe at valve outlet.
2. X-Valve is defective - allows evaporator flooding -
   Usually characterized by equal temperature of suction pipe at inlet and outlet of STV and by higher-than-normal head pressure.
3. Poor contact of X-valve bulb to suction pipe - causes evaporator flooding -
   Same characteristics as item 2.
4. Clogged compressor inlet screen -
   Usually characterized by equal temperature of suction pipe at inlet and outlet of STV and by lower-than-normal head pressure.
5. Compressor pumping capability impaired - defective valves, etc. -
   Same characteristics as Item 4.

If discharge air temperature is high and evaporator pressure is much lower than 29 psi, one of the following defects is probably responsible:

1. X-valve bulb is discharged, causing X-valve to close tight.
2. Clogged X-valve inlet screen.
3. Clogged receiver screen -
   Characterized by cold liquid line.

If discharge air temperature is normal and evaporator pressure is somewhat low (28, 27, 26 or 25 psi, for example) the STV setting is probably low and, although the system performs satisfactorily in the test it will, under other conditions, allow evaporator icing which will result in loss of airflow.

Listed below are a number of defects which will cause a relatively minor loss of capacity.

1. Excess bugs, leaves, etc. on condenser -
   Will cause higher-than-normal head pressure.
2. Excess oil in system.
3. Air in system -
   Will cause higher-than-normal head pressure.
   Will also cause internal corrosion of parts.

NOTE: Let system stand inoperative overnight. With the same gage, check first the low side pressure and then the high side pressure. If the high side pressure is significantly higher than the low side pressure, there is probably air in the system. - Purge, evacuate and recharge.

4. Excess Refrigerant 12 in system -
Will cause higher-than-normal head pressure.

REMOVAL AND INSTALLATION PROCEDURES

10. Compressor Removal and Installation (Complete)

a. Removal

1. Remove carburetor air cleaner.
2. Purge system as described in Note 5a.
3. Remove screw securing plate retaining high and low pressure connectors to compressor rear head, and remove plate.
4. Remove high and low pressure connectors (hose connectors on 693 series cars) from rear head of compressor and cap connectors.
5. Cover compressor openings with Test Plate, J-9527, to prevent dirt from entering compressor.
6. Disconnect electrical connector from clutch coil terminals.
7. Loosen bolts securing power steering pump to mounting brackets, pivot pump toward engine, and remove drive belts from compressor.
8. Remove two screws, nut and washers securing compressor rear mounting bracket to engine.
9. Remove two screws securing compressor mounting flange to front mounting bracket.
10. Remove compressor by moving upward and rearward.

b. Installation

NOTE: Before installing a replacement compressor, make certain the numeral 4 (5-1/4 on Fleetwood Seventy-Fives) is stamped 1/8 inch high on blank space provided in lower right hand corner of compressor name plate. If numeral is not evident, then stamp numeral as indicated. This numeral indicates the refrigerant capacity and must be shown on all compressors as required by law in some states.

1. Position compressor with rear mounting bracket, attached to engine and loosely install two screws securing front mounting flange to front mounting bracket.
2. Loosely install two screws, nut and washers securing compressor rear mounting bracket to engine.
3. When compressor is properly positioned, tighten front mounting screws and then tighten screws and nut securing compressor to engine.
4. Install compressor drive belts on compressor and power steering pump and adjust belts as described in Section 6, Note 11.
5. Connect electrical connector to clutch coil terminals.
6. Remove Test Plate J-9527, and using new O-rings, position high and low pressure connectors to rear head and position retaining plate to connectors.

NOTE: The O-rings in the compressor head should be oiled prior to placement in the cavity. Care should be taken not to damage these O-rings when installing the connectors.

7. Install screw and washer securing retaining plate and pressure connectors to rear head of compressor.
8. Evacuate system as described in Note 5c.
9. Charge system as described in Note 5d. Leak test all compressor connections.

CAUTION: All leaks must be repaired. Under no circumstances should a compressor be operated when a leak exists, as complete loss of refrigerant prevents oil return to the compressor.

10. Install carburetor air cleaner.

11. Compressor Removal and Installation (Partial)

In order to perform certain engine operations it is necessary to move the compressor out of the way. This can be done without disconnecting any lines as follows:

a. Removal

1. Remove carburetor air cleaner.
2. Perform steps 6 through 9, Note 10a.
3. Move complete assembly clear of working area, being careful not to kink hoses. Use rope or wire to hold compressor out of way.

b. Installation

1. Perform steps 1 through 5, Note 10b.
2. Install carburetor air cleaner.

12. Compressor Service

When servicing the compressor, remove only the necessary components that preliminary diagnosis indicates are in need of service. Refer to Fig. 1-36 for information relative to parts nomenclature and location.

Some service operations can be performed

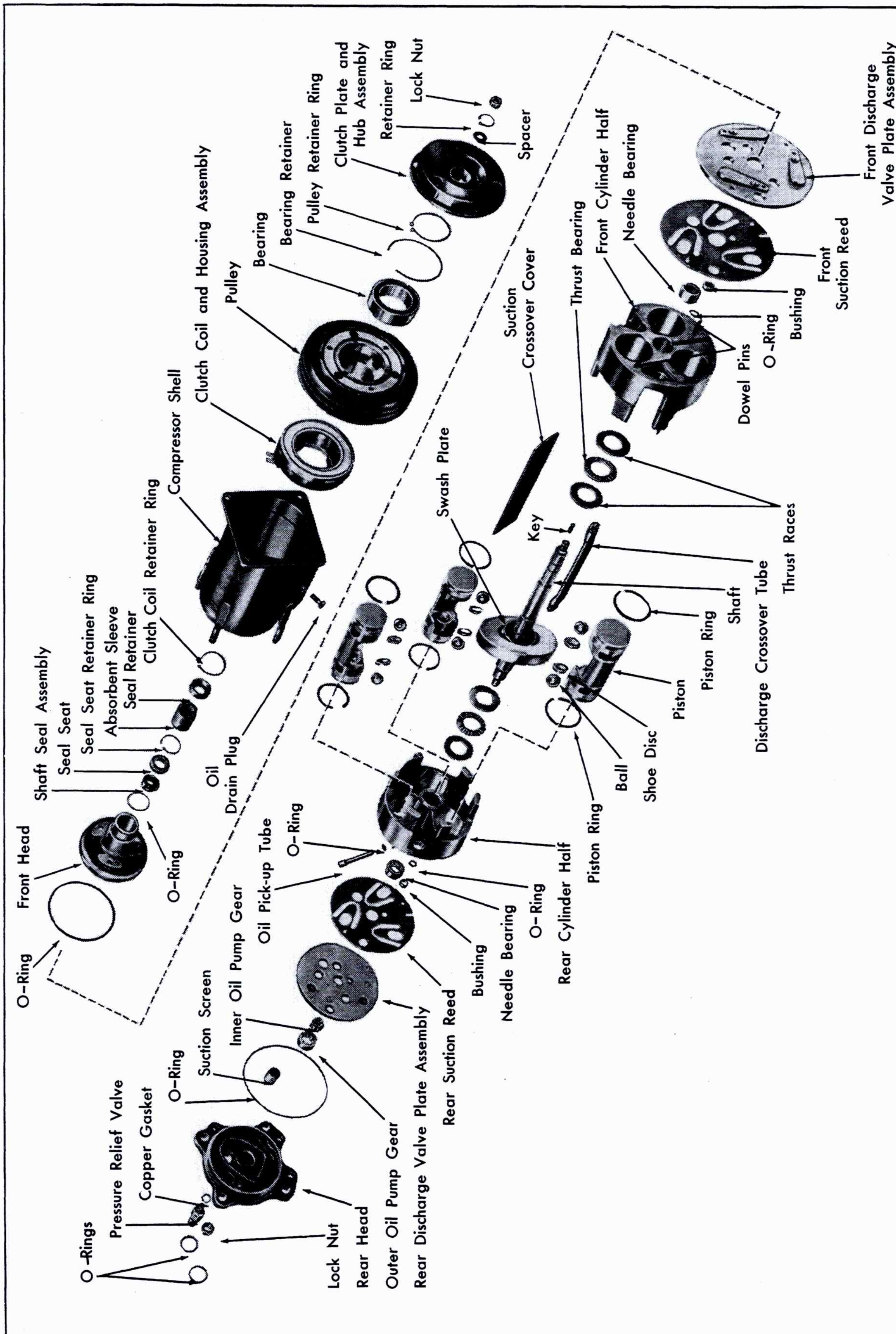


Fig. 1-36 Compressor Disassembled

without disturbing the internal mechanism assembly or completely removing the compressor from the car. Among them are replacement of the clutch plate and hub assembly, the pulley and bearing assembly, and pulley bearing.

The clutch coil and housing assembly also may be replaced without completely removing the compressor, after clutch and pulley parts have been removed. It is not necessary to disturb the shaft seal.

The shaft seal assembly can be replace only by removing the compressor from the car and removing the clutch plate and hub assembly to gain access to the seal. A complete kit of shaft seal parts is available for field replacement.

Removal and installation of external compressor components and disassembly and assembly of internal components must be performed on a clean workbench. The work area, tools, and parts must be kept clean at all times. Parts Tray, J-9402, should be used for all parts being removed as well as for replacement parts.

Although certain service operations can be performed without completely removing the compressor from the car, the operations described herein are based on bench overhaul with the compressor removed from the car. They have been prepared in sequence in order of accessibility of the components.

When a compressor is removed from the car for servicing, the amount of oil remaining in the compressor should be drained and measured. This oil should then be discarded and new oil added to the compressor as described in Note 5f.

13. Compressor Clutch Plate and Hub Assembly

a. Removal

1. Place Holding Fixture, J-9396, in a vise,

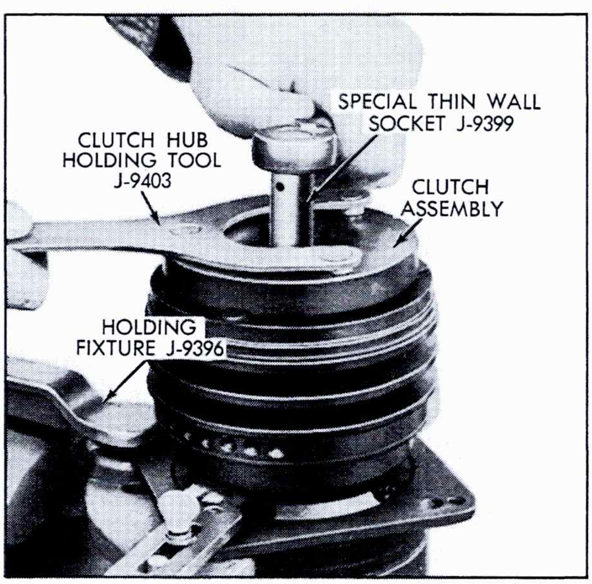


Fig. 1-37 Removing Lock Nut

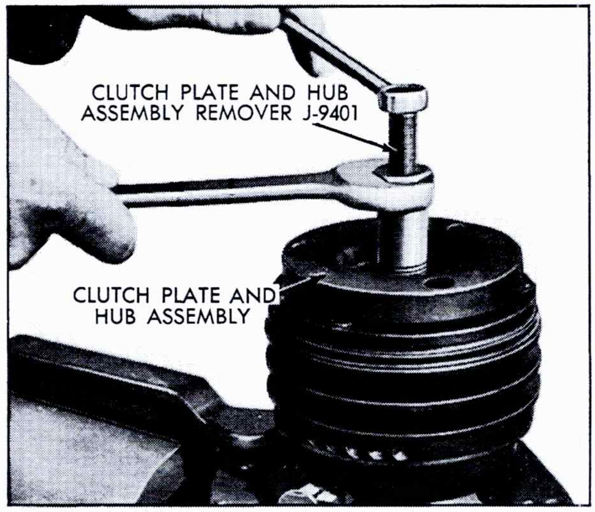


Fig. 1-38 Removing Clutch Plate and Hub Assembly

and secure compressor to fixture with pulley end up.

2. Keep clutch hub from turning with Clutch Hub Holding Tool, J-9403, and remove locknut from end of shaft. using Thin Wall Socket, J-9399, Fig. 1-37.
3. Thread Clutch Plate and Hub Assembly Remover, J-9401, into hub. Hold body of tool with a wrench and tighten center screw to remove clutch plate and hub assembly, Fig. 1-38.
4. Remove square drive key from shaft.
5. Remove hub retainer ring using Snap Ring Pliers, J-5403 (#21), and then remove hub spacer, Fig. 1-39.

b. Installation

1. Install square drive key on shaft, allowing it to project approximately 3/16 inch out of keyway.
2. Wipe frictional surface of clutch plate and pulley clean.
3. Place clutch plate and hub assembly on shaft, aligning shaft key with keyway in hub.

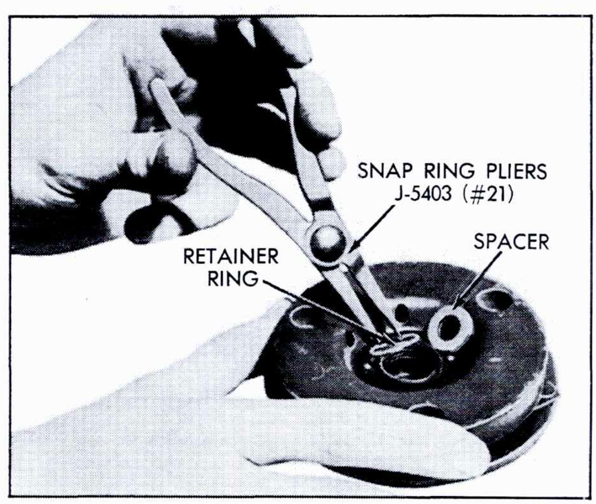


Fig. 1-39 Removing Hub Retainer Ring and Spacer

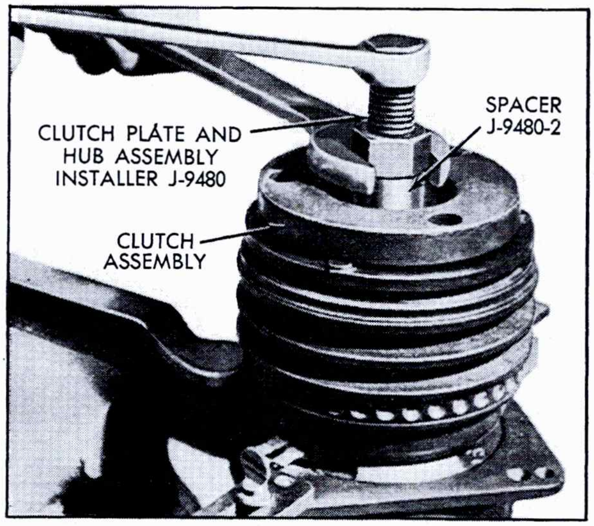


Fig. 1-40 Installing Clutch Plate and Hub Assembly

CAUTION: To avoid internal damage to compressor, do not drive or pound on hub or shaft. This could mis-position swash plate on shaft, resulting in damage to compressor.

4. Place Spacer, J-9480-2, on hub, Fig. 1-36. Insert end of Clutch Plate and Hub Assembly Installer, J-9480, through spacer and thread tool onto end of shaft.

5. Hold hex portion of tool body with a wrench and tighten center screw several turns to press hub partially on shaft, Fig. 1-40.

6. Remove Clutch Plate and Hub Assembly Installer and Spacer. Check alignment of drive key with keyway in shaft. If alignment is correct, replace installer tools and continue to press hub onto shaft until there is approximately a 3/32 inch (.093 inch) air gap between frictional surfaces of pulley and clutch plate.

NOTE: A zero thrust race is 3/32 inch thick and can be used as a gage between these frictional surfaces.

7. Remove Installer, J-9480, and Spacer, J-9480-2.

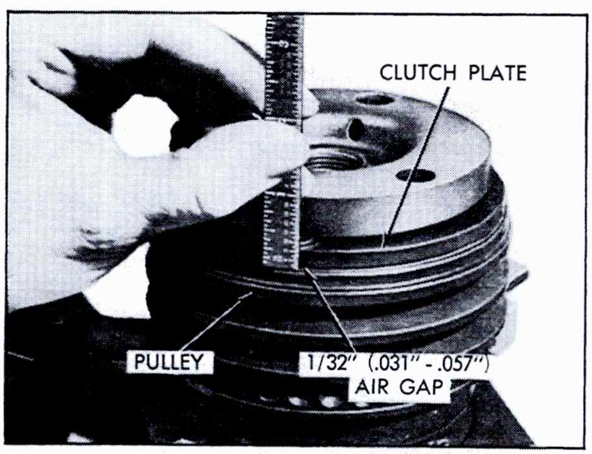


Fig. 1-41 Checking Air Gap

8. Install hub spacer.

9. Using Snap Ring Pliers, J-5403 (#21), install hub retainer ring with flat side of ring facing spacer.

10. Install a new shaft locknut with small diameter boss of nut against hub spacer, using special Thin Wall Socket J-9399, Fig. 1-37. Hold clutch hub with Clutch Hub Holding Tool, J-9403, and tighten nut to 15 foot-pounds torque, using a 0-25 foot-pounds torque wrench. Air gap between frictional surfaces of pulley and clutch plate should now be approximately 1/32 inch (.031 inch to .057 inch), Fig. 1-41.

14. Compressor Pulley and Bearing Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 13a.

2. Remove pulley retainer ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-42.

3. Pry out absorbent sleeve retainer, and remove absorbent sleeve from compressor neck.

4. Place Puller Pilot, J-9395, over end of compressor shaft.

CAUTION: It is important that Puller Pilot, J-9395, be used to prevent internal damage to compressor when removing pulley. Under no circumstances should Puller be used directly against drilled end of shaft.

5. Remove pulley and bearing assembly using Pulley Puller, J-8433, Fig. 1-43.

b. Installation

1. If original pulley and bearing assembly is to be reinstalled, wipe frictional surface of pulley clean. If frictional surface of pulley shows any indication of damage due to overheating, pulley should be replaced.

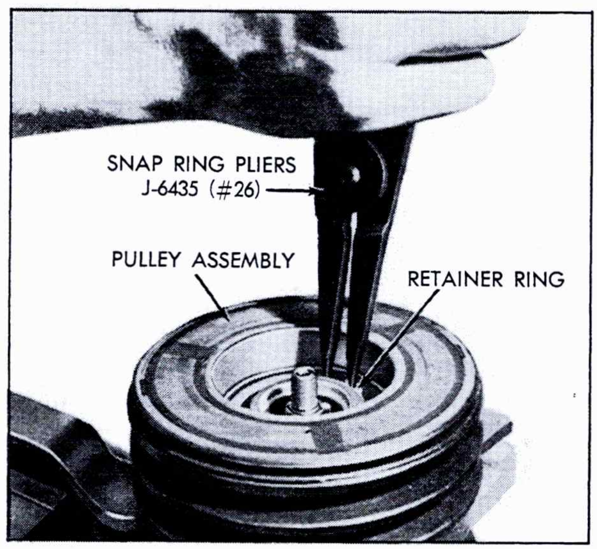


Fig. 1-42 Removing Pulley Retainer Ring

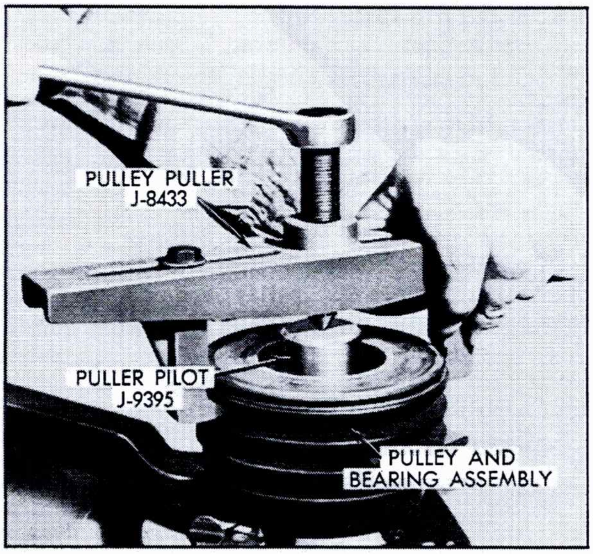


Fig. 1-43 Removing Pulley and Bearing Assembly

2. Check bearing for brinelling, excessive looseness, noise, and lubricant leakage. If any of these conditions exist, bearing should be replaced. The procedure for replacing bearing is described in Note 15.

3. Press or tap pulley and bearing assembly on neck of compressor until it seats, using Pulley and Bearing Installer, J-9481, with Universal Handle, J-8092, Fig. 1-44. Installer will apply force to inner race of bearing and prevent damage to bearing.

4. Check pulley for binding or roughness. Pulley should rotate freely.

5. Install retainer ring using Snap Ring Pliers, J-6435 (#26).

6. Install absorbent sleeve in compressor neck.

7. Install absorbent sleeve retainer in neck of compressor. Using sleeve from Seal Seat Remover J-9393, install retainer so that outer edge is recessed 1/32" from compressor neck face.

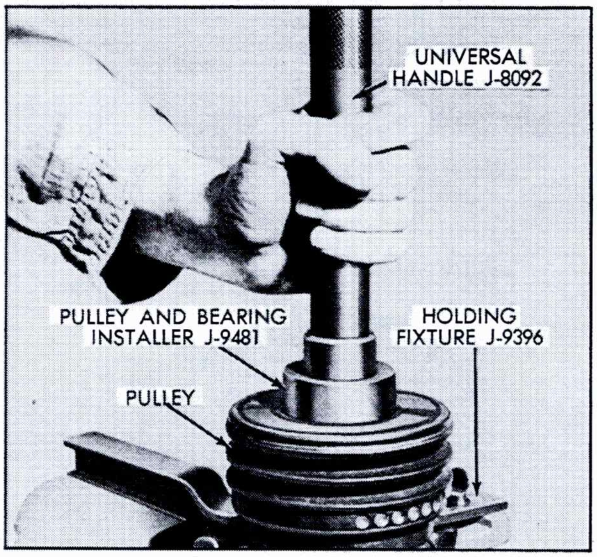


Fig. 1-44 Installing Pulley and Bearing Assembly

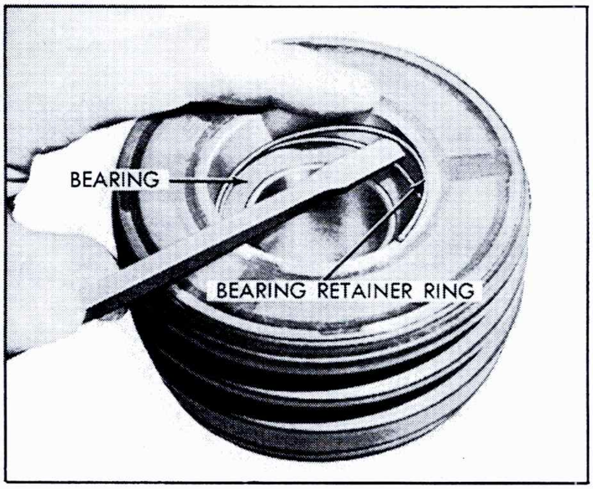


Fig. 1-45 Removing Pulley Bearing Retainer Ring

8. Install clutch plate and hub assembly as described in Note 13b.

15. Compressor Pulley Bearing Replacement

1. Remove clutch plate and hub assembly as described in Note 13a.

2. Remove pulley and bearing assembly as described in Note 14a.

3. Remove pulley bearing retainer ring with a small screwdriver or pointed tool, Fig. 1-45.

4. Place pulley and bearing assembly on inverted Support Block, J-9521, and, using Pulley Bearing Remover, J-9398, with Universal Handle, J-8092, drive bearing assembly out of pulley, Fig. 1-46.

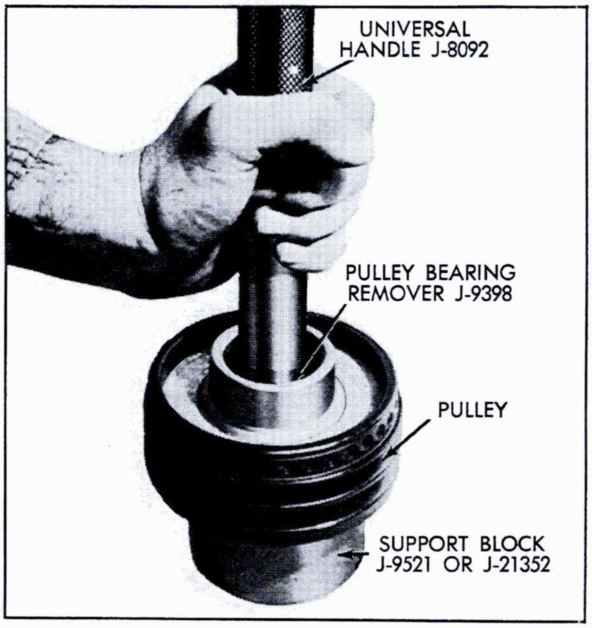


Fig. 1-46 Removing Bearing from Pulley

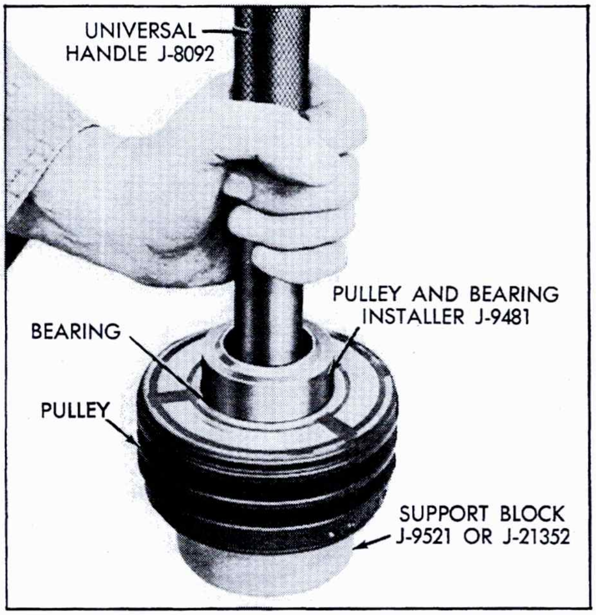


Fig. 1-47 Installing Bearing on Pulley

5. Install new bearing in pulley using Pulley and Bearing Installer J-9481 with Universal Handle, J-8092, Fig. 1-47. The tool will apply the force to the outer race of the bearing.

NOTE: Do not clean new bearing assembly with any type of solvent. Bearing is supplied with correct lubricant when assembled and requires no other lubricant at any time.

6. Install bearing retainer ring, make certain that it is properly seated in ring groove.
7. Install pulley and bearing assembly as described in Note 14b.
8. Install clutch plate and hub assembly as described in Note 13b.

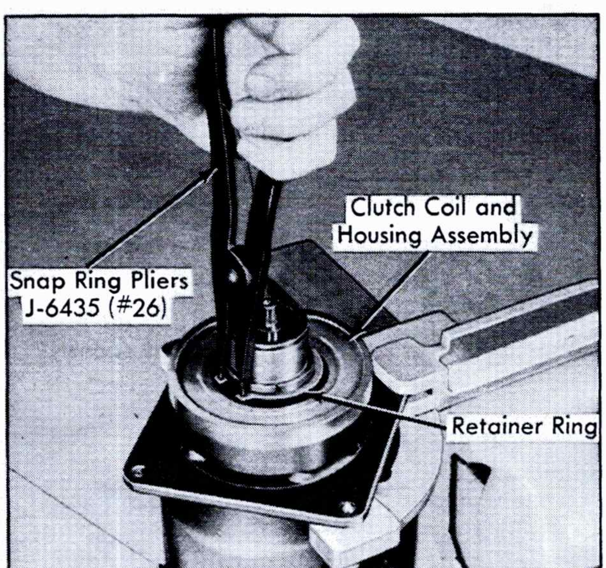


Fig. 1-48 Removing Coil Housing Retainer Ring

16. Compressor Clutch Coil and Housing Assembly

The coil has 3.85 ohms resistance at 80°F (ambient temperature) and should draw 3.2 amps at 12 volts.

a. Removal

1. Remove clutch plate and hub assembly as described in Note 13a.
2. Remove pulley and bearing assembly as described in Note 14a.
3. Note position of terminals on coil housing and scribe location on compressor front head casting.
4. Remove coil housing retaining ring using Snap Ring Pliers, J-6435 (#26), Fig. 1-48.
5. Lift coil and housing assembly off compressor.

b. Installation

1. Position coil and housing assembly on compressor front head casting so electrical terminals line up with marks previously scribed on compressor.
2. Align locating extrusions on coil housing with holes in front head casting.
3. Install coil housing retainer ring, with flat side of ring facing coil, using Snap Ring Pliers, J-6435 (#26).
4. Install pulley and bearing assembly as described in Note 14b.
5. Install clutch plate and hub assembly as described in Note 13b.

17. Compressor Shaft Seal Assembly

a. Removal

1. Remove clutch plate and hub assembly as described in Note 13a.

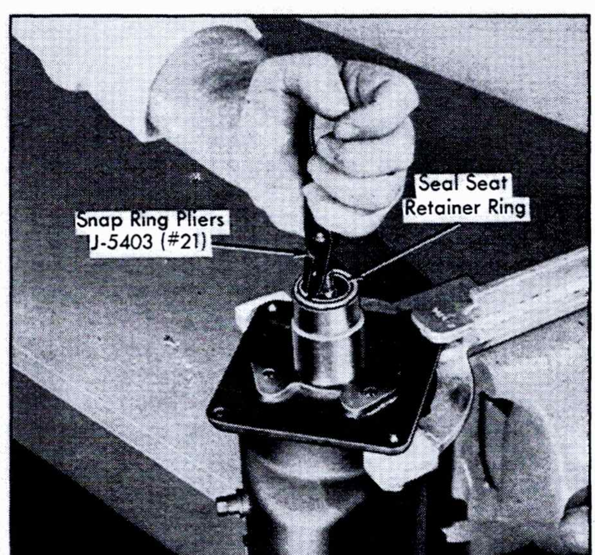


Fig. 1-49 Removing Seal Seat Retainer Ring

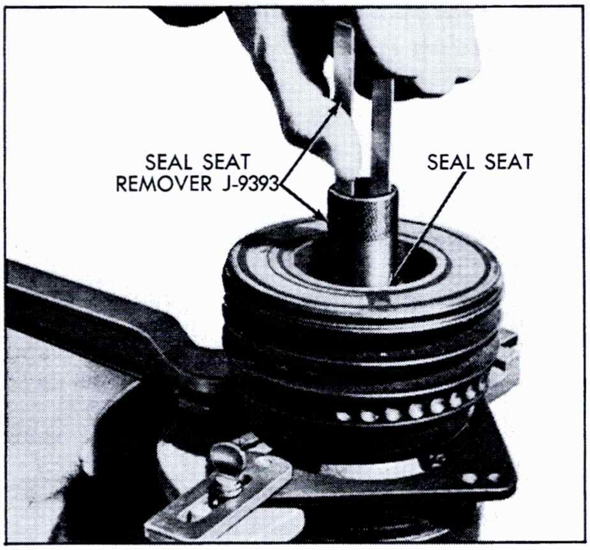


Fig. 1-50 Removing Seal Seat

2. Pry out sleeve retainer and remove sleeve.
3. Remove seal seat retainer ring using Snap Ring Pliers, J-5403 (#21), Fig. 1-49.

NOTE: Illustration shows coil and housing removed, however, this is not necessary.

4. Thoroughly clean inside of the compressor neck area surrounding the shaft, exposed portion of seal seat, and the shaft itself of any dirt or foreign material.
5. Remove seal seat using Seal Seat Remover and Installer, J-9393, Fig. 1-50. Grasp seal seat flange with tool and pull straight up on end of tool to remove seal seat.
6. Remove shaft seal assembly using Seal Remover and Installer. J-9392, Fig. 1-51. Press down on tool to overcome seal spring pressure and twist tool clockwise to engage tabs on seal

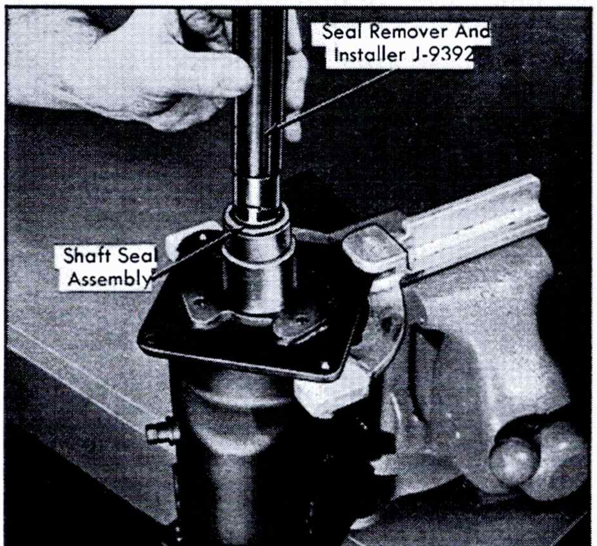


Fig. 1-51 Removing Shaft Seal Assembly

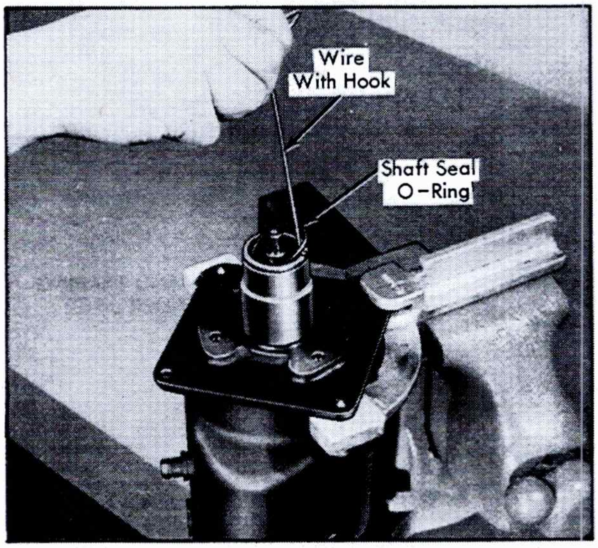


Fig. 1-52 Removing Shaft Seal O-Ring

assembly with locking tangs on tool. Remove seal assembly by pulling straight out from shaft.

7. Remove seal seat O-ring from compressor neck. A wire with a hook formed on the end may be used, Fig. 1-52.
8. Re-check the shaft and inside of compressor neck for dirt or foreign material and be sure those areas are perfectly clean before installing new parts.

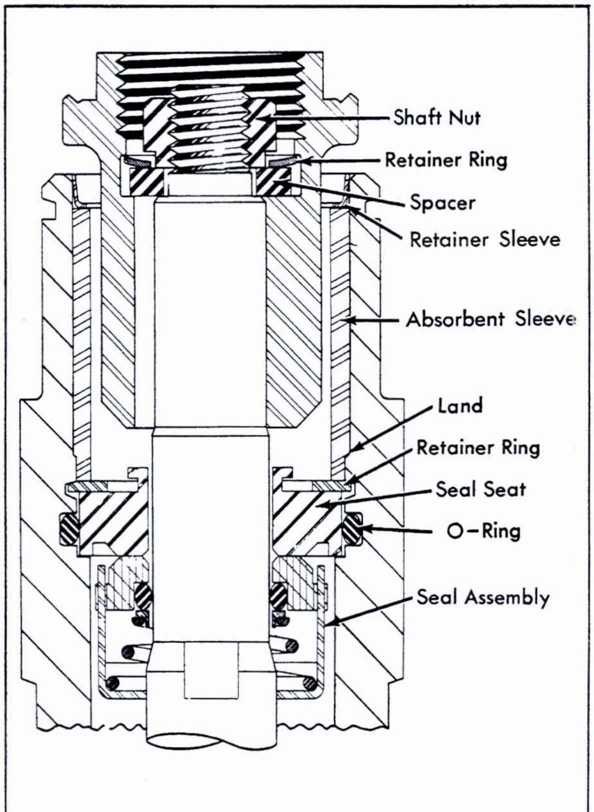


Fig. 1-53 Shaft Seal and Seat Installed

b. Installation

1. Coat new seal seat O-ring with clean refrigeration oil and install in compressor neck, making certain it is installed in bottom groove, Fig. 1-53. Top groove is for retainer ring.
2. Coat O-ring and seal face of new seal assembly with clean refrigeration oil.
3. Carefully engage tabs on new seal assembly with tangs of Seal Remover and Installer, J-9392 and install new seal assembly over flats on shaft. Turn tool counterclockwise to release it from seal tabs and remove tool.
4. Coat seal face of new seal seat with clean refrigeration oil and install new seal seat, using Seal Seat Remover and Installer, J-9393. Be sure seal seat O-ring is not dislodged and seal seat is effecting a good seal with the O-ring.

CAUTION: Seal faces of seal assembly and seal seat must be protected against dirt or any damage, such as scratches and nicks. Even finger markings are to be avoided.

5. Install new seal seat retainer ring, with flat face against the seal seat, using Snap Ring Pliers, J-5403 (#21). Sleeve from Seal Seat Remover and Installer, J-9393, may be used to press on the retainer ring so that it snaps into its groove, Fig. 1-53.
6. Leak test compressor as described in Note 24. Correct any leaks found.
7. Wipe out any excess oil inside compressor neck and on shaft, resulting from installing the new seal parts.
8. Install new absorbent sleeve by rolling the material into a cylinder, overlapping the ends, and slipping the sleeve into the compressor neck with the overlap toward top of compressor.
9. With a small screwdriver or similar instrument, carefully spread the sleeve to remove overlap so that in the final position ends of the sleeve will butt at the top vertical centerline.
10. Position new metal sleeve retainer so that its flange face will be against the end of the sleeve. Using sleeve from Seal Seat Remover, J-9393, press and tap with a soft-faced hammer, setting the retainer and sleeve into place, until the outer edge of the retainer is recessed approximately 1/32" from the face of the compressor neck.
11. Install clutch plate and hub assembly as described in Note 13b.

18. Compressor Overhaul

Whenever a compressor is ruined to the point where metal particles or black oil are prevalent, the dehydrator receiver should be replaced.

Whenever a major overhaul or rebuild is performed on a compressor, it is essential that the recommended service tools be available in order to perform the various service operations properly. In addition, an adequate supply of service parts should be available. Service parts should include the following.

1. Standard size piston drive balls.
2. Shoe discs - total of 11 sizes, including the ZERO shoe.
3. Thrust races - total of 16 sizes, including the ZERO race.
4. Pistons.
5. Main shaft needle bearings.
6. Thrust bearings.
7. Compressor shaft, swash plate and woodruff key assembly.
8. Service cylinder assembly - front, rear halves, with main bearing in place and halves dowel pinned together.
9. Major internal mechanism assembly.
10. Suction reed valve - front, rear.
11. Discharge valve assembly - front, rear.
12. Gasket service kit - containing all gaskets, seals, O-rings, etc.
13. Shaft seal kit.
14. Nuts - head to shell and shaft.
15. Retainer rings.
16. Cylinder locator pins.
17. Valve and head locator pins.
18. Service type discharge cross-over tube kit.

All service parts are protected by a preservation process and packaged in a manner that will eliminate the necessity of cleaning, washing or flushing of parts to remove preservation materials. Parts can be used just as they are removed from service package.

Certain parts are identified on the piece part to denote their size or dimension. This applies to piston shoe discs and shaft thrust races.

Gasket service kit contains shaft seal O-ring, head to shell O-rings, oil tube inlet O-ring, and discharge crossover tube O-ring. This kit should be used to replace all seals and gaskets whenever a compressor is overhauled or an individual component is replaced.

There is an optional method of handling one of the major internal components -- the cylinder assembly. A service cylinder assembly, including bearings, and both front and rear halves of cylinders mated together, is available for service.

There may be occasions where it would be desirable to use this assembly rather than the complete internal assembly. In case it is used, the gaging and parts selection operations will have to be performed as described in Note 22.

An inspection should be made of the internal mechanism assembly to determine if any service operations should be performed. A detailed inspection of parts should be made to determine if it is economically feasible to replace them. It may be more economical to replace the entire internal mechanism assembly rather than replace parts.

Before proceeding with disassembly, wipe exterior surface of compressor clean.

All oil in compressor should be drained and measured. Assist draining by positioning compressor with oil drain plug down, open suction connector and rotate drive shaft several times.

19. Compressor Internal Mechanism Removal

1. Remove clutch plate and hub assembly as described in Note 13a.
2. Remove pulley and bearing assembly as described in Note 14a.
3. Remove clutch coil and housing assembly as described in Note 16a.
4. Remove shaft seal as described in Note 17a.
5. Invert compressor and Holding Fixture, J-9396, with front end of compressor shaft down.

NOTE: Additional oil may leak from compressor at this time. All oil must be drained into a container so that total amount can be measured. A liquid measuring cup may be used for this purpose. Drained oil should then be discarded.

6. Remove four locknuts from threaded studs on compressor shell and remove rear head.

NOTE: Tap uniformly around rear head if head is binding.

7. Wipe excess oil from all teflon gasket surfaces on rear head casting webs, and examine gasket surfaces, Fig. 1-54. If any damage is observed, head should be replaced.
8. Remove suction screen and examine for any damage or contamination. Clean or replace if necessary.
9. Paint an identifying mark (prussian blue or other suitable marking material may be used) on exposed face of inner and outer oil pump gears and then remove gears.

NOTE: Identifying marks are to assure that gears, if reused, will be installed in identical position.

10. Remove and discard rear head to shell O-ring.
11. Carefully remove rear discharge valve plate assembly. Use two small screwdrivers under reed retainers and pry up on assembly, Fig. 1-55. Do not position screwdrivers between reeds and reed seats.
12. Examine valve reeds and seats. Replace

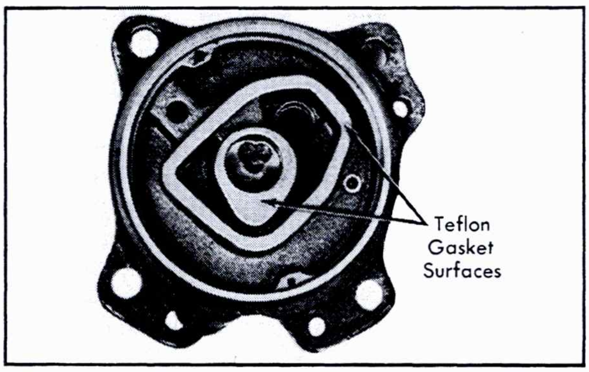


Fig. 1-54 Teflon Gasket Surfaces on Rear Head

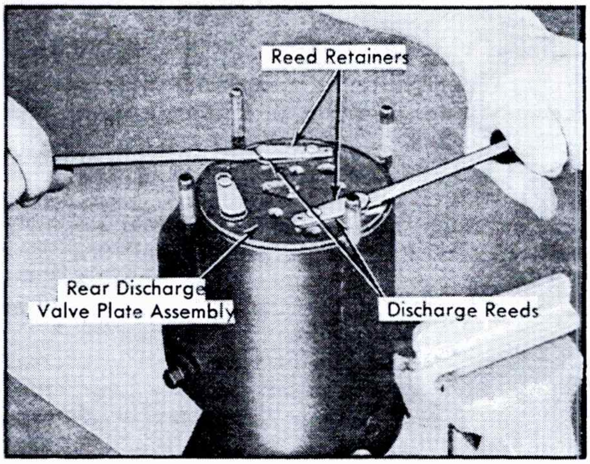


Fig. 1-55 Removing Rear Discharge Valve Plate

entire assembly if any reeds or seats are damaged.

13. Using two small screwdrivers, carefully remove rear suction reed, Fig. 1-56. Do not pry up on horseshoe shaped reed valves.
14. Examine reeds for damage, and replace if necessary.
15. Using Oil Pick-Up Tube Remover, J-5139, Fig. 1-57, remove oil pick-up tube. Remove O-ring from oil inlet.
16. Loosen compressor from Holding Fixture, place Internal Assembly Support Block, J-9521, over oil pump shaft and, holding Support Block in position with one hand, lift compressor from Holding Fixture with other hand. Invert compressor and position on bench with Internal Assembly Support Block resting on bench.
17. Lift front head and compressor shell assembly up, leaving internal mechanism resting on Internal Assembly Support Block.

CAUTION: Do not tap on end of compressor shaft to remove internal mechanism. If mechanism will not slide out of compressor shell, tap on front head with a plastic hammer.

18. Rest compressor shell on its side and push front head assembly through compressor shell,

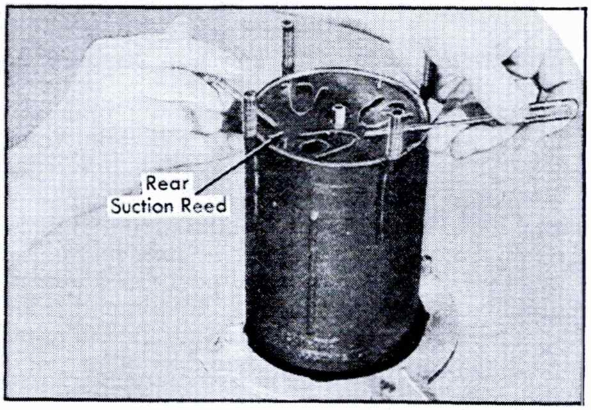


Fig. 1-56 Removing Rear Suction Reed

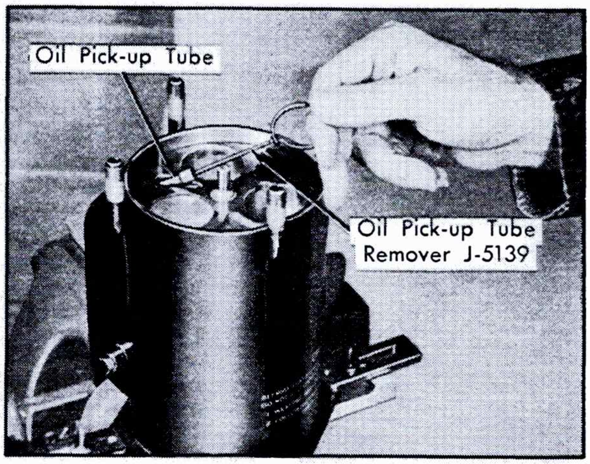


Fig. 1-57 Removing Oil Pick-Up Tube

being careful not to damage sealing areas on inner side of front head. Discard O-ring.

NOTE: It may be necessary to tap on outside of front head, using a plastic hammer, to overcome friction of O-ring seal between front head and compressor shell.

19. Wipe excess oil from sealing surfaces on front head casting webs and examine sealing surface. If any damage is observed, head should be replaced.

20. Remove front discharge valve plate assembly and front suction reed plate. Examine reeds and seats. Replace necessary parts.

21. Remove suction cross-over cover by prying with screwdriver between cylinder casting and cover.

NOTE: Examine internal mechanism for any obvious damage. If internal mechanism has sustained major damage, due to loss of refrigerant or oil, it may be necessary to use the service internal mechanism assembly rather than replace individual parts.

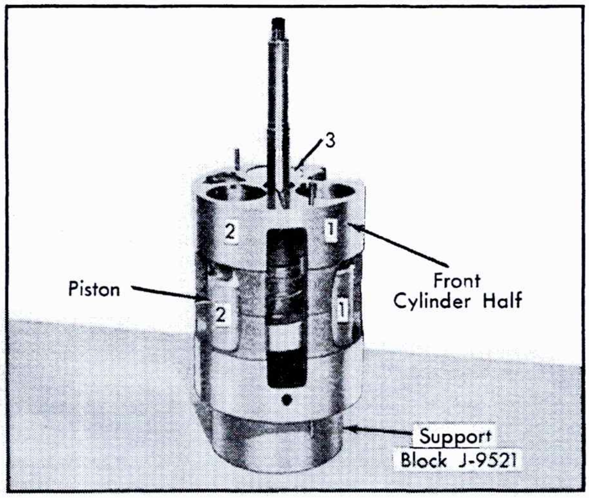


Fig. 1-58 Numbering Piston and Cylinder Bores

20. Compressor Internal Mechanism Disassembly

Use Parts Tray, J-9402, to retain compressor parts during disassembly.

1. Remove internal mechanism from compressor as described in Note 19.
2. Identify by pencil mark, or some other suitable means, each piston numbering them 1, 2, and 3, Fig. 1-58. Number the piston bores in the front cylinder half in like manner so that pistons can be replaced in their original locations.
3. Separate cylinder halves, using a wood block and mallet, Fig. 1-59. Make certain that discharge cross-over tube does not contact swash plate when separating cylinder halves.

CAUTION: Under no circumstances should shaft be struck at either end in an effort to separate upper and lower cylinder halves.

4. Position complete internal mechanism, rear cylinder down, on Support Block, J-9521, and remove front cylinder half.
5. Pull up on compressor shaft and remove piston previously identified as #1, with balls and shoe discs, from swash plate.
6. Remove and discard piston shoe discs.
7. Remove and examine piston balls, and if satisfactory for re-use, place balls in #1 compartment of Parts Tray.
8. Remove piston rings and examine for re-use. If satisfactory, place in proper slots below #1 piston in Parts Tray.
9. Place piston in #1 compartment of Parts Tray with notch in casting web at front end of piston in dimpled groove of compartment, Fig. 1-60.
10. Repeat steps 5 through 9 for pistons #2 and #3.
11. Remove front combination of thrust races and thrust bearing from shaft, Fig. 1-61. Discard races and place bearing in front bearing slot of Parts Tray.
12. Remove shaft assembly from rear cylinder half. It may be necessary to bend discharge

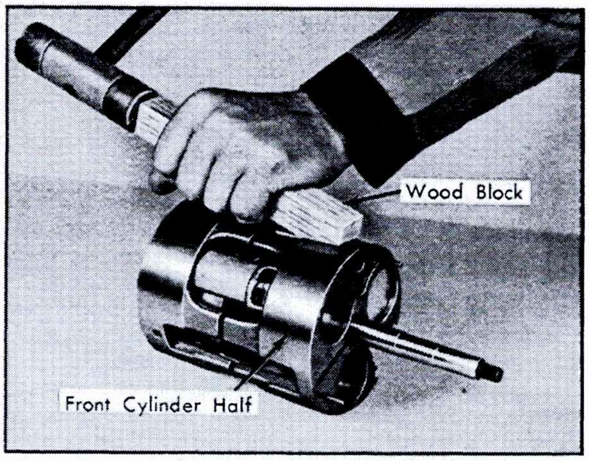


Fig. 1-59 Separating Cylinder Halves

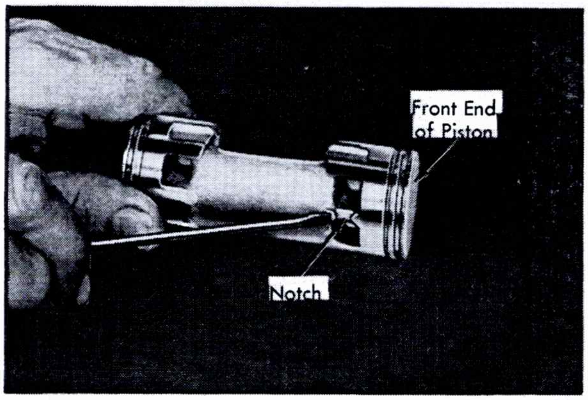


Fig. 1-60 Compressor Piston

cross-over tube slightly in order to remove shaft.

13. Remove rear combination of thrust races and bearing from shaft. Discard races and place bearing in rear bearing slot in Parts Tray.

14. Examine surface of swash plate and shaft. Replace as an assembly, if necessary. Examine front and rear thrust bearings and replace if necessary.

NOTE: A certain amount of shoe disc wear on swash plate is normal as well as some markings indicating load of needle bearings on shaft.

15. Remove discharge cross-over tube from cylinder half, using vise grip pliers.

NOTE: This is necessary only on original factory equipment as ends of the tube are swedged into cylinder halves. The discharge cross-over tube in internal mechanism assemblies that have been previously serviced have an O-ring and bushing at each end of the tube, and can be easily removed by hand.

16. Examine piston bores and needle bearings in front and rear cylinder halves. Replace front and rear cylinders if any cylinder bore is deeply scored or damaged.

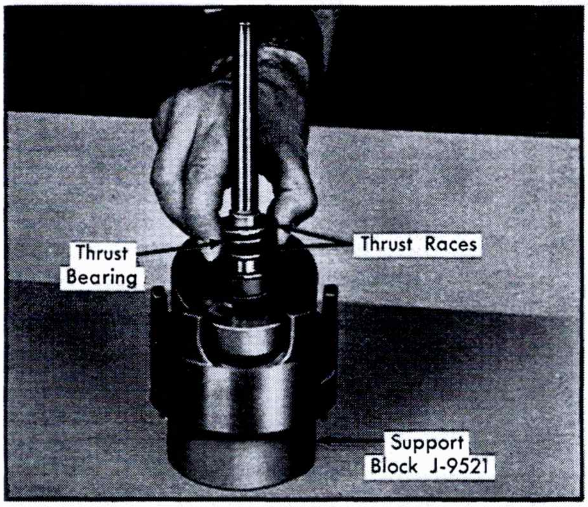


Fig. 1-61 Removing Front Thrust Races and Bearing

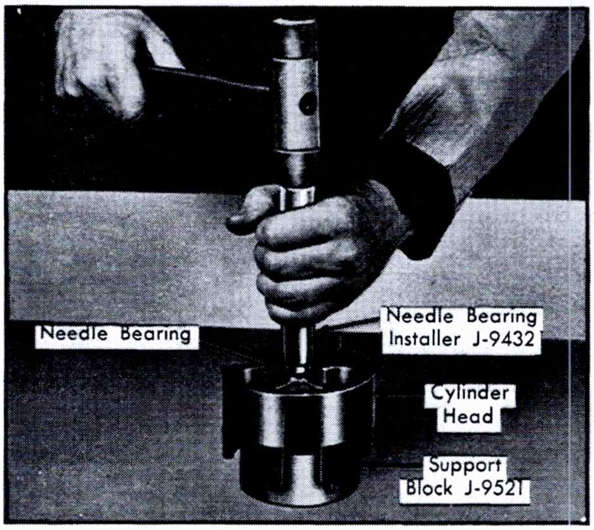


Fig. 1-62 Installing Needle Bearing

17. Needle bearings may be removed if necessary by driving them out with special Thin Wall Socket, J-9399. Insert socket in hub end (inner side) of cylinder head and drive bearing out. To install needle bearing, place cylinder half on Support Block, and insert bearing in end of cylinder head with bearing identification marks up. Use Needle Bearing Installer, J-9432, and drive bearing into cylinder head, Fig. 1-62, until tool bottoms on cylinder face.

18. Wash all parts to be re-used with trichloroethylene, alcohol, or a similar solvent. Air dry parts using a source of clean dry air.

21. Compressor Internal Mechanism Gaging Operation

1. Install Compressing Fixture, J-9397, on Holding Fixture, J-9396, in vise. Place front cylinder half in Compressing Fixture, flat side

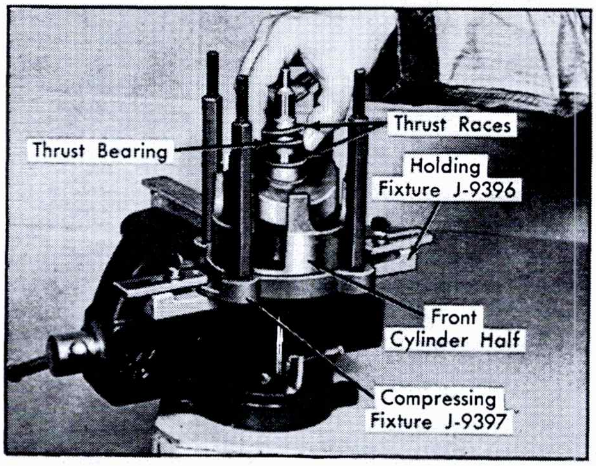


Fig. 1-63 Installing Rear Thrust Races and Bearing

down. Front cylinder half has long slot extending out from shaft hole.

2. Secure from service parts stock four zero thrust races and three zero shoe discs.

3. Install a zero thrust race, thrust bearing, and a second zero thrust race on front end of compressor shaft. Lubricate races and bearing with petrolatum.

4. Insert threaded end of shaft through needle bearing in front cylinder half, and allow thrust race and bearing assembly to rest on hub of cylinder.

5. Install a zero thrust race on rear end of compressor shaft so that it rests on hub of swash plate. Then install thrust bearing and a second zero thrust race, Fig. 1-63. Lubricate races and bearing with petrolatum.

6. Lubricate ball pockets of the #1 piston with refrigeration oil and place a ball in each socket. Use balls previously removed if they are to be re-used.

7. Lubricate cavity of a zero shoe disc with refrigeration oil and place shoe disc over ball in front end of piston, Fig. 1-64. Front end of piston has an identifying notch in casting web. Piston rings should not be installed at this time.

NOTE: Shoe discs should not be installed on rear piston balls during gaging operation.

8. Rotate shaft and swash plate until high point of swash plate is over #1 piston cylinder bore.

9. Lift shaft assembly and hold front thrust race and bearing assembly against swash plate hub.

10. Position piston over #1 cylinder bore (notched end of piston on bottom and piston straddling swash plate) and lower the shaft to allow piston to drop into its bore, Fig. 1-65.

11. Repeat steps 6 through 10 for pistons #2 and #3.

12. Install rear cylinder half on pistons, aligning cylinder with discharge cross-over tube hole in front cylinder. Tap into place using a plastic mallet.

13. Position discharge cross-over tube holes between a pair of Compressing Fixture bolts to permit access for feeler gage.

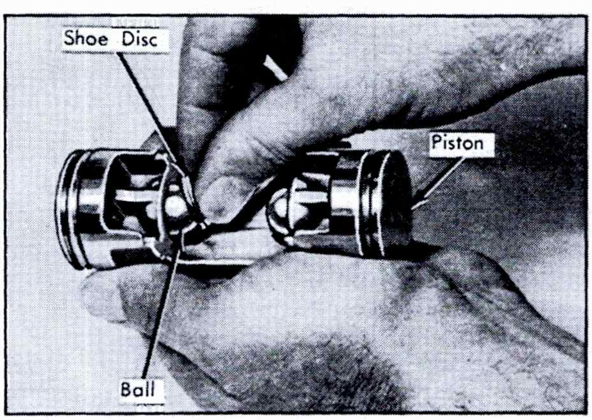


Fig. 1-64 Installing Shoe Disc

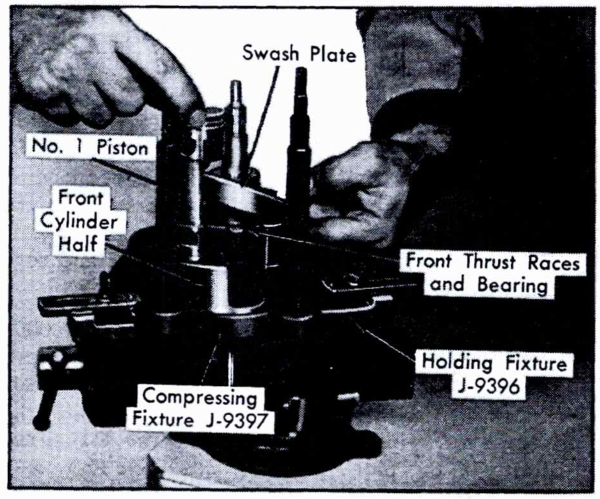


Fig. 1-65 Installing Piston

14. Install top plate on Compressing Fixture, J-9397. Tighten nuts to 15 foot-pounds torque using a 0-25 foot-pounds torque wrench.

15. Measure clearance between rear ball of #1 piston and swash plate, in following manner:

a. Select a suitable combination of well-oiled feeler gage leaves to fit snugly between ball and swash plate.

b. Attach a spring scale reading in 1 ounce increments to the feeler gage. A distributor point checking scale or Spring Scale, J-544 may be used.

c. Pull on spring scale to slide feeler gage stock out from between ball and swash plate, and note reading on spring scale as feeler gage is removed, Fig. 1-66. Reading should be between 4 and 8 ounces.

d. If reading in step (c) is under 4 or over 8 ounces, reduce or increase thickness of feeler gage leaves and repeat steps (a) through (c) until a reading of 4 to 8 ounces is obtained. Record clearance between ball and swash plate that results in a 4 to 8 ounce pull on spring scale.

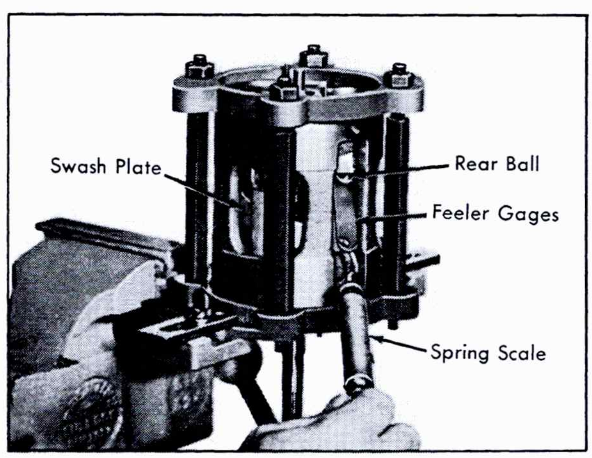


Fig. 1-66 Gaging Rear Piston Ball

16. Rotate shaft 120° and repeat step 15 between same ball and swash plate. Record this measurement.

17. Rotate shaft 120° and again repeat step 15 between these same parts and record measurements.

18. Select a numbered shoe disc corresponding to minimum feeler gage reading recorded in the three checks. Place shoe discs in Parts Tray, in compartment corresponding to piston #1 and rear ball pocket position.

NOTE: Shoe discs are provided in .0005 inch (one-half thousandths) variations. There are a total of eleven sizes available for field servicing. All shoe discs are marked with the shoe size, which corresponds to the last three digits of the piece part number. See shoe disc size chart.

Last 3 Digits of Part No.	No. Stamped on Shoe	Min. Feeler Gage Reading
000	0	.0000
175	17-1/2	.0175
180	18	.0180
185	18-1/2	.0185
190	19	.0190
195	19-1/2	.0195
200	20	.0200
205	20-1/2	.0205
210	21	.0210
215	21-1/2	.0215
220	22	.0220

Once proper selection of shoe has been made, the matched combination of shoe disc to rear ball and spherical cavity in piston must be kept in proper relationship during disassembly after gaging operation, and during final assembly of internal mechanism.

19. Repeat in detail the same gaging operation outlined in steps 15 through 18 for pistons #2 and #3.

20. Mount Dial Indicator, J-8001-3, on edge of Compressing Fixture with Clamp, J-8001-1, and Sleeve, J-8001-2, Fig. 1-67. Position Dial Indicator on rear end of shaft and adjust to zero. Push front end of shaft upward and record measurement.

NOTE: Dial Indicator increments are .001 inch; therefore, reading must be estimated to nearest .0005 inch.

21. Select a thrust race with a number corresponding to the amount of end play shown. Place thrust race in right hand slot at bottom center of Parts Tray.

NOTE: Fifteen thrust races are provided in increments of .0005 inch (one-half thousandths) thickness and one zero gage thickness providing a total of 16 sizes available for field service.

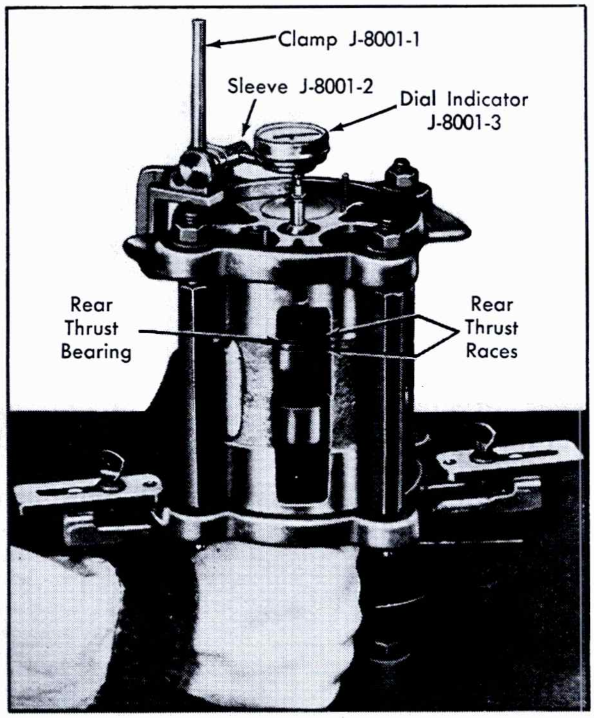


Fig. 1-67 Gaging Rear Thrust Race

Thrust races are identified on the part by their thickness in thousands in excess of the thickness of the zero thrust race.

THRUST RACE SIZE CHART

Last 3 Digits of Part No.	No. Stamped on Thrust Race	Dial Indicator Reading
000	0	.0000
050	5	.0050
055	5-1/2	.0055
060	6	.0060
065	6-1/2	.0065
070	7	.0070
075	7-1/2	.0075
080	8	.0080
085	8-1/2	.0085
090	9	.0090
095	9-1/2	.0100
100	10	.0105
105	10-1/2	.0110
110	11	.0115
115	11-1/2	.0120
120	12	

This number also corresponds to the last three digits of the piece part number. See thrust race size chart.

A tolerance of .0005 inch to .0015 inch is built into thrust races to provide a running clearance between hub surfaces of swash plate and front and rear hubs of cylinder.

22. Remove nuts from top plate of Compressing Fixture, and remove top plate.

23. Separate cylinder halves while unit is in fixture. It may be necessary to use a wood block and mallet.

24. Remove rear cylinder half and carefully remove one piston at a time from swash plate and front cylinder half. Do not lose the relationship of the front ball and shoe disc and rear ball. Transfer each piston, ball, and shoe disc to its proper place in Parts Tray.

25. Remove rear outer zero thrust race from shaft and install thrust race previously selected.

NOTE: The zero thrust race may be put aside for re-use in additional gaging or rebuilding operations.

22. Compressor Internal Mechanism Assembly

1. Install a piston ring on each end of #1 piston, with scraper groove toward center of piston.
2. Lubricate ball pockets of piston with refrigeration oil and place the corresponding balls from the Parts Tray in each pocket.
3. Lubricate cavities of #1 piston shoe discs with refrigeration oil and place zero shoe disc over ball in front end of piston and numbered shoe disc over ball in rear end of piston.
4. Rotate shaft and swash plate until high point of swash plate is over #1 piston cylinder bore.

NOTE: Make certain that front thrust race and bearing assembly adhere to swash plate hub.

5. Position piston over #1 cylinder bore with notched end of piston on bottom and piston straddling swash plate and lower shaft to allow piston to drop into its bore.
6. Position piston ring gap toward shaft, compress ring and lower ring into front cylinder half.
7. Repeat steps 1 through 6 for pistons #2 and #3.

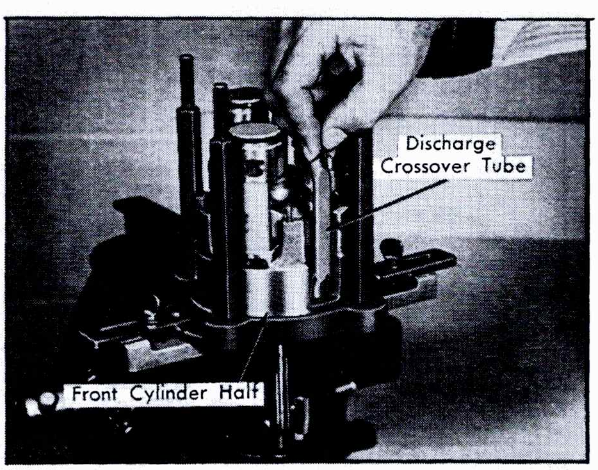


Fig. 1-68 Installing Discharge Crossover Tube

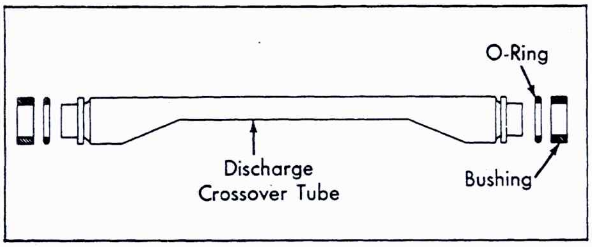


Fig. 1-69 Service Type Crossover Tube

8. Install new discharge cross-over tube in front cylinder half with bridged surface facing outboard, Fig. 1-68. Make certain that end of tube is properly centered in hole in front cylinder half.

NOTE: The service discharge cross-over tube is similar to the production type tube except that an O-ring and bushing is used at each end, Fig. 1-69. Do not install O-ring or bushing at this time.

9. Rotate shaft to position pistons in a stair-step arrangement. Position rings on each piston so that ring gaps are toward shaft, then push rings as far outboard as possible.
10. Place rear cylinder half over shaft and start pistons and rings into cylinder bores.
11. When all three pistons and rings are in their respective bores, align end of discharge cross-over tube with hole in rear cylinder half. Make certain that bridged surface of tube faces outboard for swash plate clearance.
12. When satisfied that all parts are in proper alignment, tap rear cylinder half with a mallet to seat it over the locating dowel pins.
13. Remove internal mechanism from fixture and place on bench.
14. Bending suction cross-over cover slightly, start it into one end of dove tail slot in cylinder halves. Align cover with ends of cylinder faces by gently tapping end of cover with a plastic hammer.

23. Compressor Internal Mechanism Installation

1. Place internal mechanism on Internal Assembly Support Block J-9521, with rear end of shaft in block hole.
2. Install new O-ring and bushing on front end of discharge cross-over tube, Fig. 1-70. The O-ring and bushing are service parts only for internal mechanisms that have been disassembled in the field.
3. Install new dowel pins in front cylinder half, if previously removed.
4. Install front suction reed plate on front cylinder half. Align with dowel pins, suction ports, oil return slot, and discharge cross-over tube, Fig. 1-71.

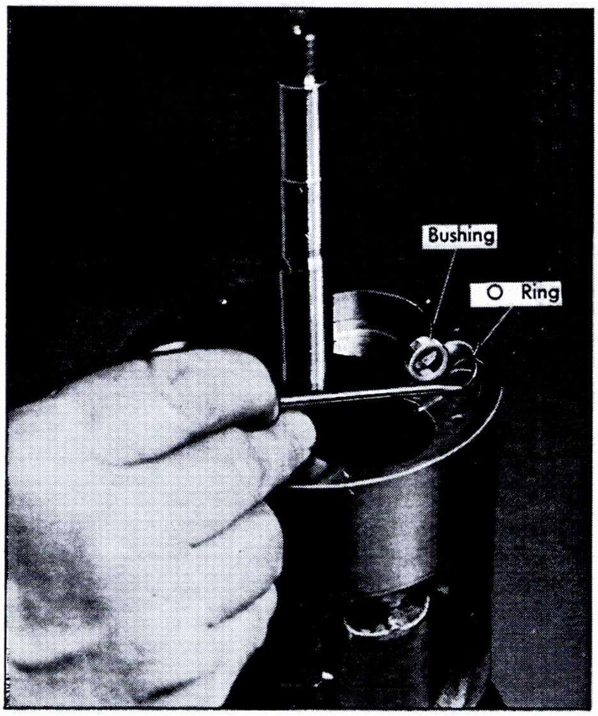


Fig. 1-70 Installing O-Ring on Crossover Tube

5. Install front discharge valve plate assembly, aligning holes with dowel pins and proper openings in front suction reed plate, Fig. 1-72.

NOTE: Front discharge plate has a large diameter hole in the center, Fig. 1-73.

6. Coat gasket sealing surfaces on webs of

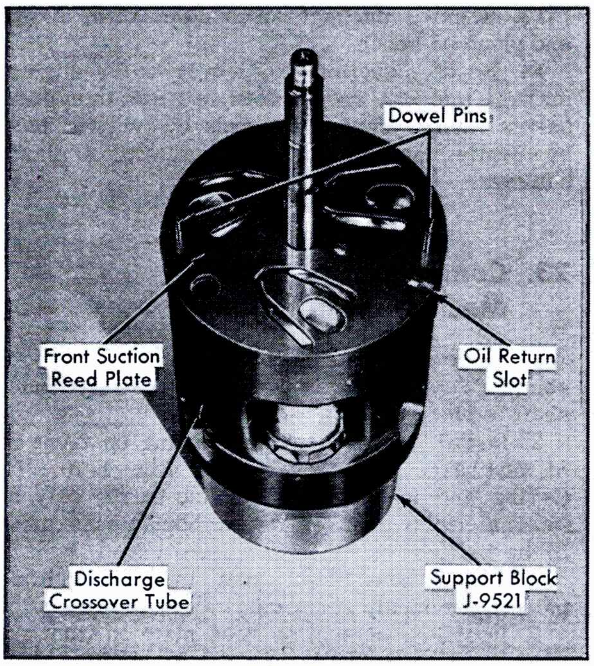


Fig. 1-71 Installing Front Suction Reed

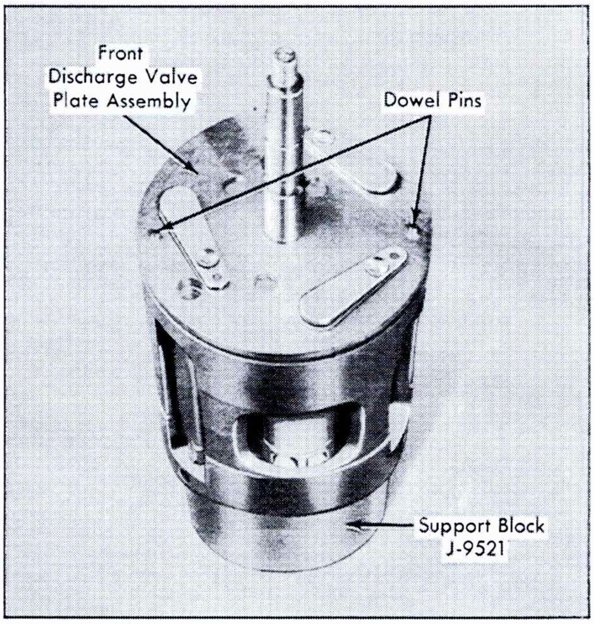


Fig. 1-72 Installing Front Discharge Valve Plate

compressor front head casting with 525 viscosity refrigeration oil.

7. Determine exact position of front head casting in relation to dowel pins on internal mechanism. Mark position of dowel pins on sides of front head assembly and on sides of internal mechanism with a grease pencil. Carefully lower front head casting into position, Fig. 1-74, making certain that sealing area around center bore of head assembly does not contact shaft as head assembly is lowered. Do not rotate head assembly to line up with dowel pins, as sealing areas would contact reed retainers.

8. Generously lubricate angled groove at lower edge of front head casting with 525 viscosity refrigeration oil and install new O-ring in groove, Fig. 1-75.

9. Coat inside machine surfaces of compressor

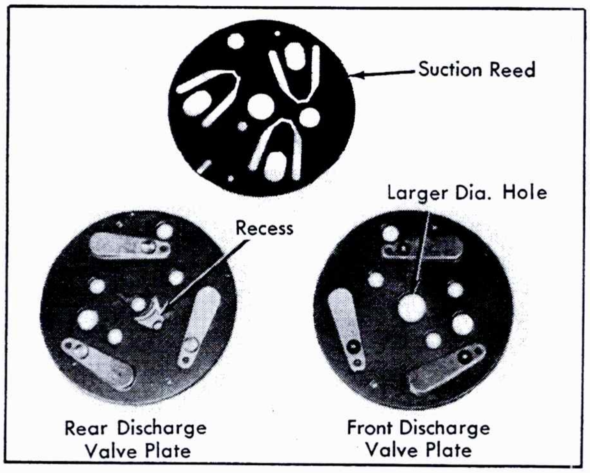


Fig. 1-73 Front and Rear Discharge Valve Plates

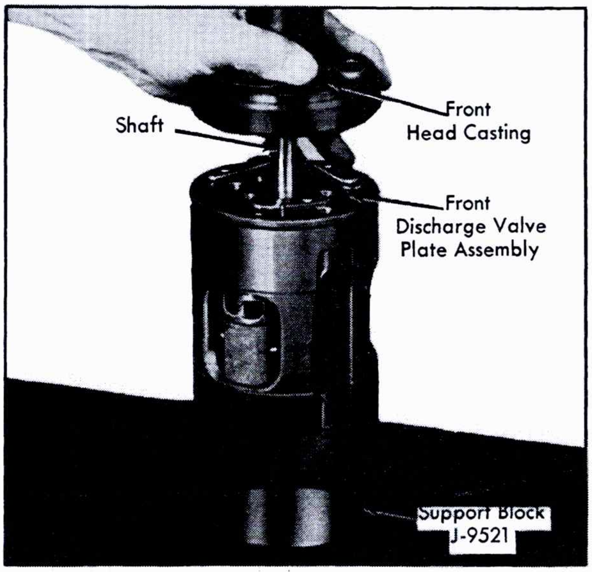


Fig. 1-74 Installing Front Head Casting

shell with 525 viscosity refrigeration oil and position shell on internal mechanism, resting on O-ring seal.

10. Using flat side of a small screwdriver, gently press O-ring in around circumference of internal mechanism until compressor shell slides down over internal mechanism. As shell slides down, line up oil sump with oil intake tube hole, Fig. 1-76.

11. Holding support block, invert assembly and place in holding fixture with front end of shaft down. Remove support block.

12. Install new dowel pins in rear cylinder half if previously removed.

13. Install new O-ring in oil pick-up tube cavity.

14. Lubricate oil pick-up tube and install in

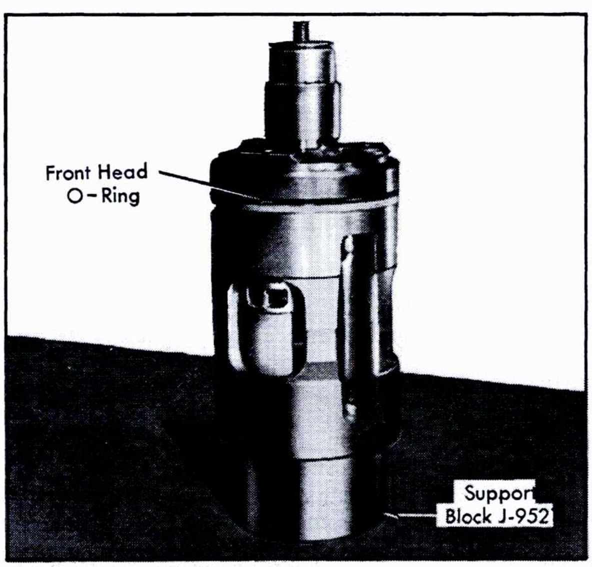


Fig. 1-75 Front Head O-Ring Installed

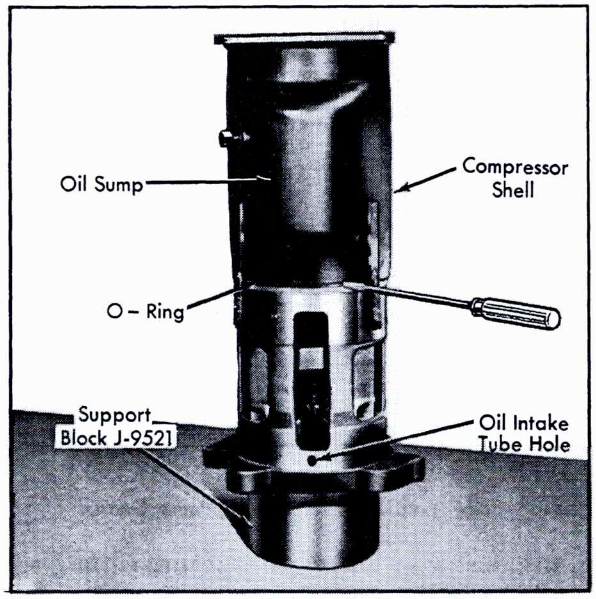


Fig. 1-76 Installing Compressor Shell

cavity, rotating compressor mechanism to align tube with hole in shell baffle, Fig. 1-77.

15. Install new O-ring and bushing on rear of discharge cross-over tube.

16. Install rear suction reed over dowel pins with slot toward sump.

17. Install rear discharge valve plate assembly over dowel pins with reed retainers up.

18. Position inner oil pump gear over shaft with previously applied identification mark up.

19. Position outer oil pump gear over inner gear with previously applied identification mark up and, when standing facing oil sump, position outer gear so that it meshes with inner gear at the 9 o'clock position and cavity between gear teeth is at 3 o'clock position, Fig. 1-78.

20. Generously oil rear discharge valve plate assembly around outer edge where large diameter O-ring will be placed. Oil valve reeds, pump

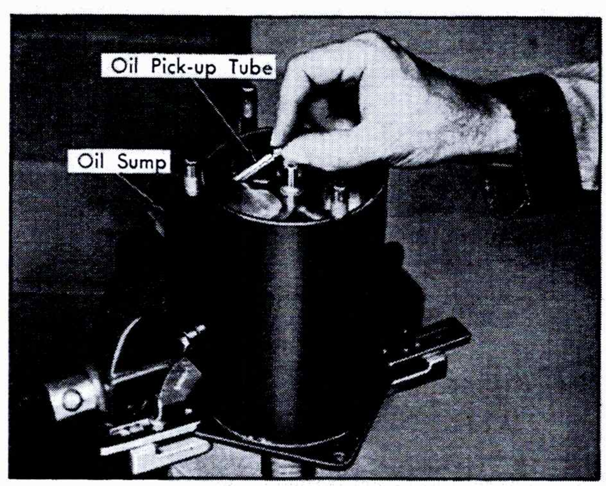


Fig. 1-77 Installing Oil Pick-Up Tube

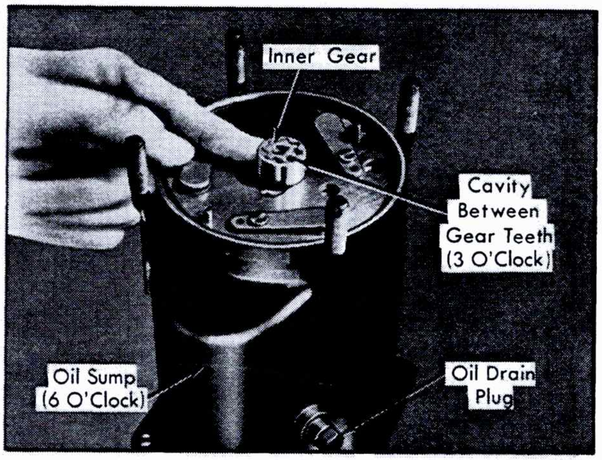


Fig. 1-78 Positioning Oil Pump Gears

gears, and area where teflon sealing surface will contact rear discharge valve plate.

21. Lubricate new head-to-shell O-ring and install on rear discharge valve plate, in contact with shell.

22. Install suction screen in rear head casting, using care not to damage screen.

23. Coat teflon sealing surface on webs of compressor rear head casting with 525 viscosity refrigeration oil.

24. Install rear head assembly over studs on compressor shell. The two lower threaded compressor mounting holes should be in alignment with the compressor sump. Make certain that suction screen does not drop out of place when lowering rear head into position.

NOTE: If rear head assembly will not slide down over dowels in internal mechanism, twist front head assembly back and forth very slightly by hand until rear head drops over dowel pins.

25. Install nuts on threaded shell studs and tighten evenly to 20 foot-pounds torque using a 0-25 foot-pounds torque wrench.

26. Invert compressor in holding fixture and install shaft seal as described in Note 17b.

27. Install compressor clutch coil and housing assembly as described in Note 16b.

28. Install compressor pulley and bearing assembly as described in Note 14b.

29. Install compressor clutch plate and hub assembly as described in Note 13b.

30. Add 525 viscosity refrigeration oil as described in Note 5f.

31. Check for external and internal leaks as described in Note 24.

24. Compressor Leak Testing (External and Internal)

1. Rotate clutch hub clockwise several turns to pick oil up from sump and carry it to piston rings and oil seals.

2. Install Test Plate, J-9527, on rear head of compressor.

3. Attach center hose of gage manifold set on Charging Station to a refrigerant drum standing in an upright position and open valve on drum.

4. Connect charging station high and low pressure lines to corresponding fittings on Test Plate.

NOTE: High pressure fitting is one farthest from high pressure relief valve on compressor rear head.

5. Open valve 1 (low pressure control), valve 2 (high pressure control), and valve 4 on Charging Station to allow refrigerant vapor to flow into compressor.

6. Using Leak Detector Torch, J-6084, check for leaks at pressure relief valve, oil drain fitting, compressor rear head seal, compressor front head seal and compressor shaft seal. After checking, shut off valve 1 and valve 2 on Charging Station.

7. If an external leak is present, perform the necessary corrective procedures and repeat steps 1 through 6 to make certain leak has been corrected before proceeding with steps 8 through 12 to check for internal leaks.

8. Disconnect manifold gage hoses from test plate.

9. Connect low pressure hose of gage manifold set to high pressure fitting on Test Plate, J-9527.

10. Open charging station valve 1 (low pressure control) to allow refrigerant vapor to flow into compressor.

11. Observe reading on pressure gage then close valve 1. If gage reading drops to 10 pounds or under in 30 seconds or less, it indicates that compressor is leaking internally, at one or more of the following points:

a. Reed valves.

b. Teflon seals at rear head, or sealing surfaces on front head.

c. Cross-over tube.

d. Raised section on cylinder face.

12. If a leak is indicated in step 11, perform necessary corrective procedures to eliminate internal leak and repeat steps 1 through 11 to make certain external and internal leaks are corrected. If no leak was indicated, proceed with step 13.

13. Disconnect charging station from test plate.

14. Remove test plate from compressor.

25. Condenser

a. Removal

1. Disconnect line from condenser side of receiver.

2. Disconnect high pressure vapor line at fitting on top right side of condenser.

3. Remove four nuts, two each side, securing condenser mounting brackets to rubber mounts.

4. Lift condenser upward, disengaging it from rubber mounts. When lower mounting brackets on condenser come under upper mounts, tip top of

condenser forward to allow mounting brackets to clear mounts, and remove condenser from car.

b. Installation

1. Add refrigeration oil as described in Note 5f.
2. With top of condenser tipped forward, lower condenser into position until lower mounting brackets will go under upper rubber mounts. Tip condenser vertical and lower until all four mounting brackets are resting on rubber mounts.
3. Secure mounting brackets to rubber mounts with four nuts, two each side.
4. Connect high pressure vapor line to fitting at top right side of condenser using a new O-ring.
5. Connect liquid line to dehydrator-receiver using a new O-ring.

26. Dehydrator-Receiver

The sight glass is an integral part of the dehydrator-receiver. No service should be performed on this assembly.

a. Removal

1. Purge system as described in Note 5a.
2. Disconnect condenser pipe at COND side of sight glass. Cap condenser pipe if condenser is not being replaced.
3. Disconnect high pressure liquid line at EVAP side of sight glass and cap liquid line.

NOTE: Cap fittings if original dehydrator-receiver is to be reinstalled.

4. Remove high pressure liquid line at condenser.
5. Remove one screw from dehydrator-receiver mounting bracket.
6. Remove dehydrator-receiver by tilting unit and lifting out of engine compartment.

b. Installation

NOTE: Do not uncap new assembly, except to add refrigeration oil, until it is clamped in position, as it will quickly absorb moisture from the air, decreasing its efficiency or rendering it completely useless. Keep it capped at all times.

1. Install refrigeration oil, as described in Note 5f, if new dehydrator-receiver is to be installed, and recap dehydrator-receiver.
2. Position dehydrator-receiver in mounting bracket, making certain it engages locating tab and secure with one screw.

NOTE: Make certain dehydrator-receiver fittings are in line with condenser pipe and high pressure liquid line before tightening mounting bolts.

3. Remove caps from COND side of dehydrator-receiver and condenser pipe and install condenser pipe to COND fitting side of sight glass, using a new O-ring.
4. Remove caps from EVAP side of dehydrator-receiver and high pressure liquid line and install high pressure liquid line to EVAP fitting side of sight glass, using a new O-ring.
5. Install high pressure line at condenser.
6. Evacuate system as described in Note 5c.
7. Charge system with refrigerant as described in Note 5d and leak test dehydrator-receiver and condenser connections.
8. Check operation of system.

27. Blower-Evaporator Assembly

a. Removal

1. Remove heater air modulator assembly as described in Note 32a.
2. Purge system as described in Note 5a.
3. Disconnect high pressure liquid line at expansion valve, and cap line.
4. Disconnect low pressure line at suction throttling valve, and cap line.
5. Disconnect wiring at seat warmer relay and connector leading to seat warmer sending unit.
6. Remove horseshoe clip retaining water control valve to mounting bracket and move water control valve, with all hoses attached to engine.
7. Remove eight screws securing blower-evaporator assembly to cowl.
8. Remove blower-evaporator assembly.

b. Installation

1. Guide blower-evaporator assembly onto stud and secure with eight screws. Blower motor ground is secured by one of these screws.
2. Position water control valve to mounting bracket and install horseshoe retaining clip.
3. Connect wiring at seat warmer relay and connector leading to seat warmer sending unit.
4. Using a new O-ring, connect high pressure liquid line to expansion valve.
5. Connect low pressure vapor line to suction throttling valve, using a new O-ring.
6. Using body caulking compound, seal blower-evaporator assembly to prevent leaks.
7. Evacuate system as described in Note 5c.
8. Charge system as described in Note 5d and leak test all connections.
9. Install heater-air modulator assembly as described in Note 32b.

28. Evaporator Core

a. Removal

1. Remove blower-evaporator assembly as described in Note 27a.
2. Disconnect oil bleed line and equalizer line from suction throttling valve.
3. Disconnect suction throttling valve from evaporator outlet pipe and remove screw securing suction throttling valve clamp to brace on blower-evaporator case and remove valve.

4. Remove insulation and power element bulb from evaporator outlet pipe.
5. Disconnect expansion valve from evaporator inlet pipe, remove screw securing expansion valve clamp to brace on blower-evaporator case and remove valve.
6. Remove four screws securing front and rear sections of blower evaporator case together.
7. Lift off front section of blower-evaporator case.
8. Remove two screws securing evaporator core to rear section of blower-evaporator case and remove evaporator core.

b. Installation

1. Position evaporator core to rear section of blower-evaporator case and secure to rear section with two screws.
2. Install sponge rubber seal around outlet pipe and oil bleed line, and install sponge rubber grommet around inlet pipe.
3. Position front section of blower-evaporator case to rear section, making certain that sponge rubber seal and grommet are properly seated, and securing with four screws.
4. Add refrigeration oil as described in Note 5f.
5. Position expansion valve clamp to brace on blower-evaporator case and connect expansion valve to evaporator inlet pipe, using a new O-ring.
6. Install screw securing expansion valve clamp to brace.
7. Position suction throttling valve clamp to brace on blower-evaporator case and connect suction throttling valve to evaporator outlet pipe, using a new O-ring.
8. Install screw securing suction throttling valve clamp to brace.
9. Install power element bulb on evaporator outlet pipe and replace insulation.
10. Using new O-rings, connect equalizer and oil bleed lines to suction throttling valve.
11. Install blower-evaporator assembly as described in Note 27b.

29. POA Suction Throttling Valve

a. Removal

1. Purge system as described in Note 5a.
2. Disconnect low pressure vapor line from suction throttling valve and cap line.
3. Disconnect oil bleed line and external equalizer line from POA suction throttling valve.
4. Remove screw securing POA suction throttling valve clamp to brace on front of blower-evaporator assembly case.
5. Disconnect fitting on evaporator outlet pipe from POA suction throttling valve and remove valve.
6. Remove clamp from POA suction throttling valve.

b. Installation

1. Install clamp on POA suction throttling valve.
2. Connect POA suction throttling valve to fitting on evaporator outlet pipe, using a new O-ring.
3. Position POA suction throttling valve clamp to brace on front of blower-evaporator assembly case, and secure with screw.
4. Using new O-rings, connect equalizer and oil bleed lines to POA suction throttling valve.
5. Connect low pressure vapor line to POA suction throttling valve, using a new O-ring.
6. Evacuate system as described in Note 5c.
7. Charge system as described in Note 5d, and leak test all connections.
8. Check operation of system.

30. Expansion Valve

a. Removal

1. Purge system as described in Note 5a.
2. Remove insulation from power element bulb on evaporator outlet pipe and remove bulb clamp and bulb. Note routing of small tubes before removal.
3. Disconnect external equalizer line from POA suction throttling valve.
4. Disconnect high pressure liquid line from expansion valve and cap line.
5. Remove screw securing expansion valve clamp to brace on front of blower-evaporator assembly case.
6. Disconnect expansion valve from evaporator inlet pipe fitting and remove expansion valve.
7. Remove clamp from expansion valve.

b. Installation

1. Install clamp on expansion valve.
2. Using a new O-ring, connect expansion valve to evaporator inlet pipe fitting.
3. Install screw securing expansion valve clamp to brace on front of blower-evaporator assembly case.
4. Connect high pressure liquid line to expansion valve, using a new O-ring.
5. Using a new O-ring, connect external equalizer line to suction throttling valve.
6. Attach power element bulb to evaporator outlet pipe and secure with clamp.

NOTE: Use new clamp, if necessary, to obtain tight fit of bulb to tubing. Carefully route small tubes to clear water hoses.

7. Carefully replace insulation around power element bulb, as insulation must be packed tightly around bulb.
8. Evacuate system as described in Note 5c.
9. Charge system as described in Note 5d and leak test all connections.
10. Check operation of system.

31. Blower Motor

a. Removal

1. Disconnect negative battery cable.
2. Remove one screw and flatwasher securing antenna bracket to wheel housing.
3. Remove rubber cooling hose from nipple and blower motor.
4. Disconnect electrical connector at lead to motor.
5. Remove five screws securing blower to case and remove blower. Rotating the blower 180° will facilitate removal.

b. Installation

1. Place a bead of sealer around opening where blower will contact case.
2. With flat edge of blower motor vertically aligned with outboard edge of car, guide blower motor against cowl and rotate into position and place on locating dowel.
3. Install ground wire to blower to case screw at 2 o'clock position.
4. Secure capacitor to blower to case screw at 6 o'clock.
5. Install three remaining screws securing blower to case.
6. Connect electrical connector at lead to motor.
7. Install cooling hose on motor and nipple.
8. Reinstall one screw and flatwasher securing antenna bracket to wheel housing.

32. Heater and Air Modulator Assembly

a. Removal

1. Disconnect negative battery cable.
2. Remove air cleaner.
3. Drain radiator coolant.
4. Disconnect two heater hoses at heater air selector assembly.
5. Remove connector from blower relay.
6. Remove wiring connector from power servo.
7. Remove neutral switch, vacuum storage tank, and Automatic Level Control hoses from vacuum check valve.
8. Remove two nuts and flatwashers and one screw and flatwasher that secures right tie strut to fender and cowl. Remove tie strut.
9. Repeat step 8 on left side. If car is equipped with Automatic Level Control, position tie strut, with compressor attached, in engine compartment.
10. Disconnect thermal vacuum hose.
11. Remove wiring harness from two retaining clips.
12. Remove white vacuum hose at water control valve.
13. Remove two screws that secure vacuum harness connector to cowl.
14. Remove six air selector to cowl screws.
15. Remove one nut and blower relay ground wire from stud that holds air selector assembly to cowl.
16. Remove two screws that secure fuse block and drop it out of way.
17. Remove four screws that secure mode selector.
18. Pull vacuum harness connector into passenger compartment and disconnect the two parts.
19. Guide heater and air modulator assembly from engine compartment.

b. Installation

1. Guide heater-air modulator assembly into engine compartment and secure with 6 screws and one nut. Nut also secures blower ground wire. Make sure gasket at evaporator remains in proper position.
2. Have helper push vacuum harness connector forward and secure halves of connector. Secure vacuum harness connector to cowl with two screws.
3. Install four screws that secure mode selector.
4. Install fuse block and secure with two screws.
5. Install white vacuum hose at water control valve.
6. Install neutral switch, vacuum storage tank and Automatic Level Control hoses at vacuum check valve.
7. Attach wiring harness at two retaining clips.
8. Connect thermal vacuum hose.
9. Install cowl to wheel housing tie struts, securing each one with two nuts, screw and flatwashers.
10. Install connector at power servo.
11. Install connector at blower relay.
12. Connect two heater hoses at heater-air modulator assembly.
13. Fill radiator with coolant.
14. Install air cleaner.
15. Connect negative battery cable.

33. Mode Selector

a. Removal

1. Remove two screws that secure fuse block and drop it out of way.
2. Disconnect blue vacuum hose at defroster vacuum power unit.
3. Disconnect tan vacuum hose at mode vacuum power unit.
4. Disconnect purple inlet vacuum hose and wiring connector at solenoid vacuum valve.
5. Remove duct sensor connector.
6. Remove all outlet hoses.
7. Remove four screws that secure mode selector and remove assembly.

b. Installation

1. Position mode selector and secure with four screws.
2. Connect duct sensor connector.
3. Connect purple inlet vacuum hose and wiring connector at solenoid vacuum valve.

4. Connect tan vacuum hose at mode vacuum power unit.
5. Connect blue vacuum hose at defroster vacuum power unit.
6. Secure fuse block with two screws.
7. Secure all outlet hoses.

34. Heater Core

a. Removal

1. Remove heater and air modulator assembly as described in Note 32a.
2. Remove four screws securing heater core frame to heater-air modulator case.
3. Remove gasket from mounting flange of heater-air modulator case.
4. Pull heater core frame, with heater core attached, away from heater-air modulator case.
5. Remove rubber grommets from heater inlet and outlet fittings.
6. Remove four screws, one each corner, securing wire retaining clamps to heater core frame. Remove retaining clamps and remove core.

b. Installation

1. Position heater core to heater core frame.
2. Position wire retaining clamps over heater core ends and secure to heater core frame with four screws, one in each corner.
3. Position heater core and frame to heater-air modulator case, guiding heater core fittings through openings in heater-air modulator case.
4. Install four screws securing heater core frame to heater-air modulator assembly.
5. Install gasket on heater-air modulator mounting flange.
6. Install rubber grommets on heater inlet and outlet fittings and position grommets to seal openings in heater-air modulator case.
7. Install heater and air modulator assembly as described in Note 32b.

35. Water Control Valve

NOTE: The thermal vacuum valve is installed on 693 and 697 rear units only and is serviced with the water control valve as an assembly.

a. Removal

1. Pinch off valve inlet and outlet water hoses.
2. Remove clamps securing hoses to valve, and remove water hoses.
3. Remove vacuum hose from water control valve.
4. On 693 and 697 rear units, remove vacuum hoses from thermal vacuum valve.
5. Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.
2. Install water hoses on valve inlet and outlet ttings and install clamps on hoses.
3. Remove clamps pinching off hoses.
4. On all but 693 and 697 rear units, install white vacuum hose at water control valve.
5. On 693 and 697 rear units, install red vacuum hose at water control valve. Install yellow and purple vacuum hoses on thermal vacuum valve so yellow hose connects to vacuum nipple closest to water outlet fitting.
6. Replace any coolant lost.

36. Air Conditioning Outlets

The procedures for removing and installing the outlets are described in Section 12, Notes 73, 74 and 75.

37. In-Car Sensor and Switch

The procedure for removing and installing the in-car sensor and switch is described in Section 12, Note 72.

38. Ambient Switch and Sensor Assembly

a. Removal

1. Remove three screws securing right sill plate to sill and remove sill plate.
2. Remove right cowl kick pad by sliding rearward.
3. Disconnect electrical connector from terminals of ambient switch and sensor.
4. Remove two screws securing ambient switch and sensor assembly to air inlet assembly and remove switch and sensor assembly.

b. Installation

1. Position ambient switch and sensor assembly to air inlet assembly and secure with two screws.
2. Connect electrical connector to terminals of ambient switch and sensor.
3. Install right cowl kick pad by sliding forward between instrument panel and right side of cowl.
4. Position sill plate to sill and secure with three screws.

39. Duct Sensor

a. Removal

1. Disconnect electrical connector from sensor terminals.
2. Remove screw securing sensor to air selector and remove duct sensor. Duct sensor also provides floor bleed and should have an adjustable deflector installed on it.

b. Installation

1. Position duct sensor on air selector and secure with screw.
2. Connect electrical connector at sensor terminals.
3. Position floor bleed deflector properly.

40. Transducer

a. Removal

1. Remove steering column lower cover as described in Section 12, Note 45a.
2. Disconnect vacuum hoses from fittings on transducer.
3. Disconnect transducer electrical connector.
4. Remove two screws securing transducer to Automatic Climate Control panel assembly and remove transducer.

b. Installation

1. Position transducer on Automatic Climate Control panel assembly and secure with two screws.
2. Connect transducer electrical connector.
3. Connect vacuum hoses at fittings on transducer. Smaller hose goes on lower fitting.
4. Install steering column lower cover as described in Section 12, Note 45b.

41. Automatic Climate Control Air Conditioner Control Panel

The procedure for removing and installing the control panel is described in Section 12, Note 71.

42. Air Conditioning Control Panel Disassembly and Assembly

The control panel must be removed as described in Section 12, Note 71 to perform any of the following procedures.

a. Amplifier Circuit Board and Printed Circuit Board Removal

1. Disconnect green wire from temperature dial rheostat terminal.
2. Disconnect connector at transducer.
3. Remove two screws securing amplifier case to control panel. Separate amplifier from case and remove case.
4. Remove one screw securing printed circuit board to control panel and carefully remove amplifier circuit board and printed circuit board.

b. Installation

1. Position amplifier circuit board and printed circuit board on control panel. Secure printed circuit board to control panel with one screw.
2. Secure amplifier into cutouts in case and secure case to control panel with two screws.
3. Secure connector to transducer.
4. Connect green wire at temperature dial rheostat terminal.

c. Temperature Dial Rheostat Removal

1. Disconnect green lead from rheostat terminal.
2. Remove two screws securing rheostat bracket to mounting plate and remove rheostat.

d. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and install two screws securing rheostat bracket to mounting plate.
2. Connect green lead to rheostat terminal.
3. After installing control panel on car, adjust temperature dial as indicated in Note 9c.

e. Control Vacuum Valve Removal

1. Remove screw securing control vacuum valve to mounting plate.
2. Remove spring clip securing control vacuum valve to mounting plate and remove control vacuum valve.

f. Control Vacuum Valve Installation

1. Position control vacuum valve on mounting plate and secure with spring clip and screw.

43. Power Servo Removal and Installation

a. Removal

1. Remove vacuum hoses from servo valve.
2. Disconnect vacuum hose from power servo vacuum power unit.
3. Disconnect electrical connector from power servo.
4. Remove horseshoe clip securing adjusting link to temperature door arm and disengage link from arm.
5. Remove three screws securing power servo to heater-air modulator and remove power servo unit.

b. Installation

1. Position power servo unit to heater-air modulator and secure with three screws. Attach ground wire to one of the screws.
2. Adjust temperature door link as described in Note 9b.
3. Connect electrical connector to power servo.
4. Install vacuum hoses on servo valve according to colors indicated on servo dust cover.
5. Connect vacuum hose to power servo vacuum power unit.

44. Power Servo Vacuum Valve Removal and Installation

a. Removal

1. Remove vacuum hose assembly connector from servo valve.
2. Remove four screws securing dustshield to power servo and remove dustshield.
3. Remove spring clip securing valve to mounting stud.
4. Remove screw securing valve to power servo and remove valve.

b. Installation

1. Position valve on power servo and secure with screw.
2. Install spring clip securing valve to mounting stud.
3. Position dustshield on power servo and secure with four screws.
4. Install vacuum hose assembly connector on servo valve, if valve was replaced with power servo on car.

45. Solenoid Vacuum Valve

a. Removal

1. Disconnect electrical connector at vacuum solenoid.
2. Remove vacuum hoses from solenoid.
3. Remove screw securing solenoid to mode selector.
4. Remove solenoid.

b. Installation

1. Locate solenoid on mode selector so that pin engages mode selector. Secure with screw.
2. Attach purple hose to terminal that points straight away from coil.
3. Attach two remaining hoses to vacuum solenoid.
4. Connect electrical connector at vacuum solenoid.

46. Vacuum Harness

a. Engine Harness Removal

1. Disconnect four vacuum hoses at power servo.
2. Remove white vacuum hose at water control valve.
3. Disconnect purple vacuum hose at vacuum check valve.
4. Remove two screws that secure vacuum harness connector to cowl.
5. Separate vacuum harness connector at cowl and remove as an assembly.

b. Engine Harness Installation

1. Have helper push vacuum harness connector forward and secure halves of connector. Secure vacuum harness connector to cowl with two screws.
2. Connect purple vacuum hose at vacuum check valve.
3. Secure white vacuum hose at water control valve.
4. Connect four vacuum hoses on servo valve according to colors indicated on servo dust cover.

c. Passenger Harness Removal

1. Disconnect purple vacuum hose at solenoid vacuum valve.
2. Disconnect blue vacuum hose at defroster vacuum power unit.
3. Disconnect tan vacuum hose at mode door vacuum power unit.
4. Disconnect orange vacuum hose at air inlet door vacuum power unit.
5. Remove steering column lower cover as described in Section 12, Note 45a.
6. Disconnect nultiple vacuum harness connector at control head.
7. Remove two screws that secure vacuum harness to cowl.
8. Separate vacuum harness connector at cowl and remove as an assembly.

d. Passenger Harness Installation

1. Have helper push vacuum harness connector forward and secure halves of connector. Secure vacuum harness connector to cowl with two screws.
2. Connect multiple connector at control head.
3. Install steering column lower cover as described in Section 12, Note 45b.
4. Connect orange vacuum hose at air inlet door vacuum power unit.
5. Connect tan vacuum hose at mode door vacuum power unit.
6. Connect blue vacuum hose at defroster vacuum power unit.
7. Connect purple vacuum hose at solenoid vacuum valve.

GENERAL DESCRIPTION SERIES 680-1-2-3 HEATER ONLY

NOTE: For information pertaining to the Fleetwood Eldorado, refer to the latter portion of this section.

The 1969 Cadillac heating system uses the air-mix system of heat regulation. With the exception of the distribution ducts, all components are mounted on the firewall in the engine compartment.

The heating system incorporates a single heater-blower assembly mounted on the right

hand side of the cowl, Fig. 1-79. This unit provides heated air for the front and rear passenger compartments, and to the windshield for defogging and defrosting.

Outside air is drawn through the cowl vent, through the ventilation duct, and into the heater-blower assembly. The blower motor then forces a portion of the incoming air through the heater core into the distributor duct. The remaining incoming air is forced directly into the distributor duct. To obtain the desired discharge air temperature, the heated and unheated air are mixed in the necessary proportions.

The temperature of the air discharged into the passenger compartment is controlled by the temperature door inside of the heater blower assembly. This door regulates the mixing of the heated and unheated air.

Heated air is delivered to the front of the passenger compartment through openings in the heater distributor, located in the center of the dash panel. Air for the defroster system is discharged through the two outlets at the top of the heater distributor.

The heater control panel, Fig. 1-80, is located in the instrument cluster to the left of the steering column. The fan switch provides three speeds - low, medium and high.

Advancing the heater-defroster lever to the HEAT position vents the vacuum operated air inlet door, Fig. 1-79, opening it to admit outside air into the heater-blower assembly, where it is heat conditioned and delivered to the passenger compartment in the manner previously described. In the HEAT position, the heater distributor is so designed that a small portion of the discharge air is always directed to the windshield through the defroster outlets.

Moving the heater-defroster lever to the DEFROST position causes the vacuum-operated defroster door to open so that most of the discharge air is directed to the windshield, while the remaining discharge air is directed to the floor outlets. In all positions of the heater-defroster lever, the fan switch controls the three blower speeds.

The temperature lever, Fig. 1-80, turns the blower on and off and operates the temperature door, Fig. 1-79, that controls the temperature of the discharge air by regulating the mixing of heated and unheated air. With the lever in the OFF position, the air flow through the heater core is completely blocked. As the lever is moved to the right, the temperature door opens, admitting heated air into the distributor duct, and progressively decreasing the amount of unheated air.

In the extreme RH position, the unheated air is completely blocked, directing all of the incoming air through the heater core.

All 1969 Cadillacs without air conditioning are equipped with a variable restrictor at the heater

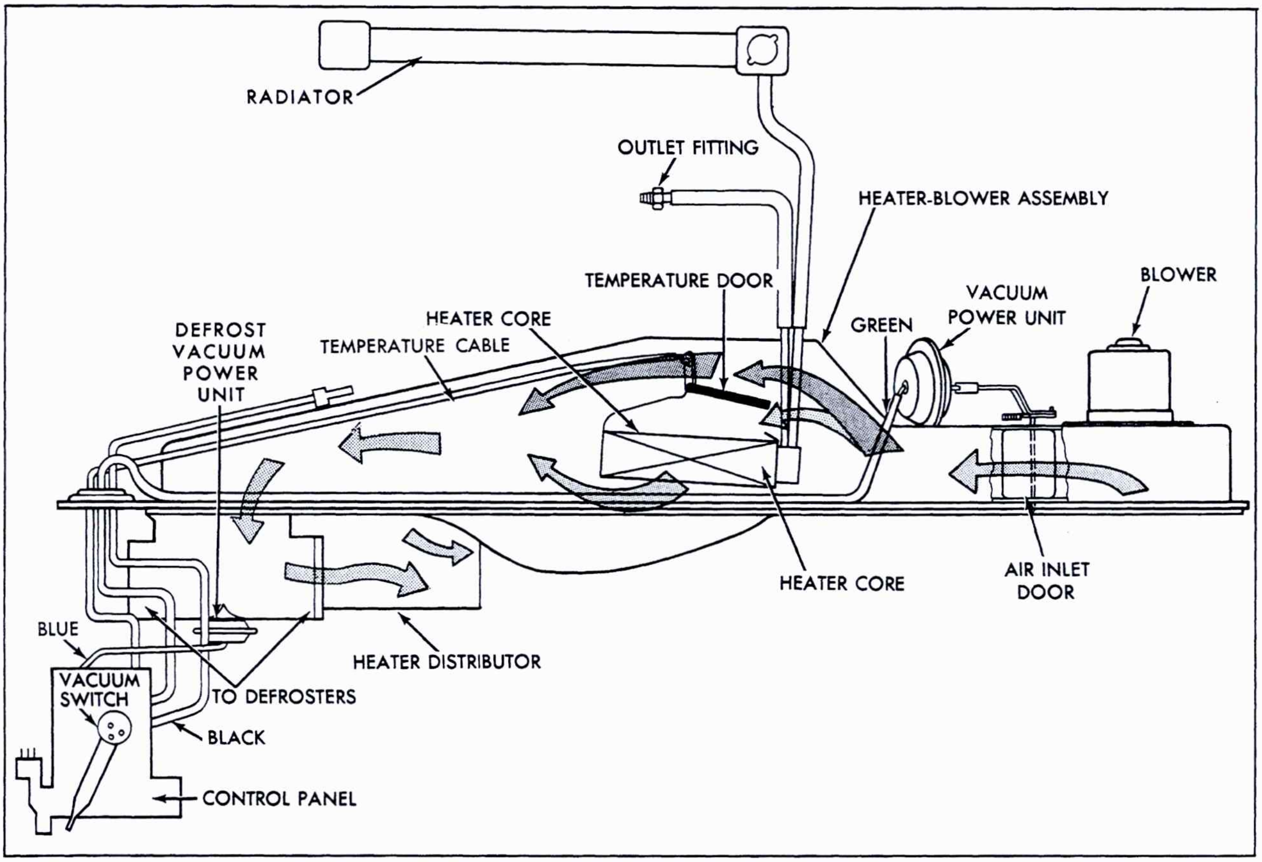


Fig. 1-79 Heater Components

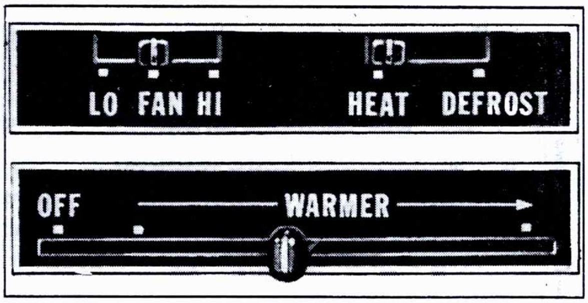


Fig. 1-80 Heater Control Panel

outlet fitting on the crankcase nipple. This restrictor serves to regulate both water flow and water pressure to the heater core as the pressure in the engine cooling system rises due to increasing engine speed.

Ventilation

On cars not equipped with air conditioning an upper level - lower level ventilation system is provided to circulate outside air through the passenger compartment. Ventilating air enters the car through an opening at the base of the windshield and is discharged into the passenger compartment either through grilles in the cowl side trim panels (lower level) or through grilles in the instrument panel, one on the left and one on the right side (upper level). On 682 and 683 styles air exhaust grilles are incorporated into the door lock pillars to allow air to leave the car, providing positive air flow even when windows are closed.

Separate control knobs for each of the ventilation outlets are located in the cowl side trim panels. The upper knobs control air flow from the grilles in the instrument panel; the lower knobs control air flow from the grilles in the cowl side trim panels. Pulling out the knobs opens air doors which admit air to the grilles. The knobs can be pulled out partially or all the way to admit as much air as desired. The vanes in the left outlet on the instrument panel can be set to direct air to the right or left; those in the outlet on the right will direct air up and down. The downward louver travel on the outboard portion of the right outlet is restricted to make it more convenient to use the ash tray in the righthand door armrest.

Electrical Circuit

The heater electrical circuit is illustrated in Fig. 1-81. The current flows from the battery through the ACC terminal of the ignition switch, and through a 15 ampere fuse to the master ON-OFF switch, located on the control panel. When the master switch is closed, current flows to the blower control switch that directs it through the blower resistor, from which it flows to the blower motor, then to ground.

47. Upper Level Ventilation Door Adjustment

NOTE: There is no adjustment for the lower level ventilation door.

1. Loosen screw that secures upper level ventilation door bowden cable clamp and position bowden cable so that door fully closes when knob is pushed all the way inward.

48. Heater Control Panel

The procedure for removing and installing the Heater Control Panel assembly is described in Section 12, Note 70.

49. Blower Resistor

a. Removal

1. Disconnect electrical connector to blower resistor at heater blower assembly.
2. Remove two screws and resistor from heater-blower assembly.

b. Installation

1. Position blower resistor on heater blower assembly and secure with two screws.
2. Connect electrical connector at blower resistor.

50. Heater Blower Motor

a. Removal

1. Disconnect negative battery cable.
2. Remove one screw and flatwasher securing antenna bracket to wheel housing.
3. Disconnect electrical connector at lead to motor.
4. Remove five screws securing blower to case and remove blower. Rotating the blower 180° will facilitate removal.

b. Installation

1. Place bead of sealer around opening where blower will contact case.
2. With flat edge of blower motor vertically aligned with outboard edge of car, guide blower motor against cowl and rotate into position and place on locating dowel.
3. Install six screws securing blower to case.
4. Connect electrical connector at lead to motor.

51. Heater-Blower Assembly

a. Removal

1. Disconnect negative battery cable.
2. Drain cooling system.
3. Remove blower motor as described in Note 50a.

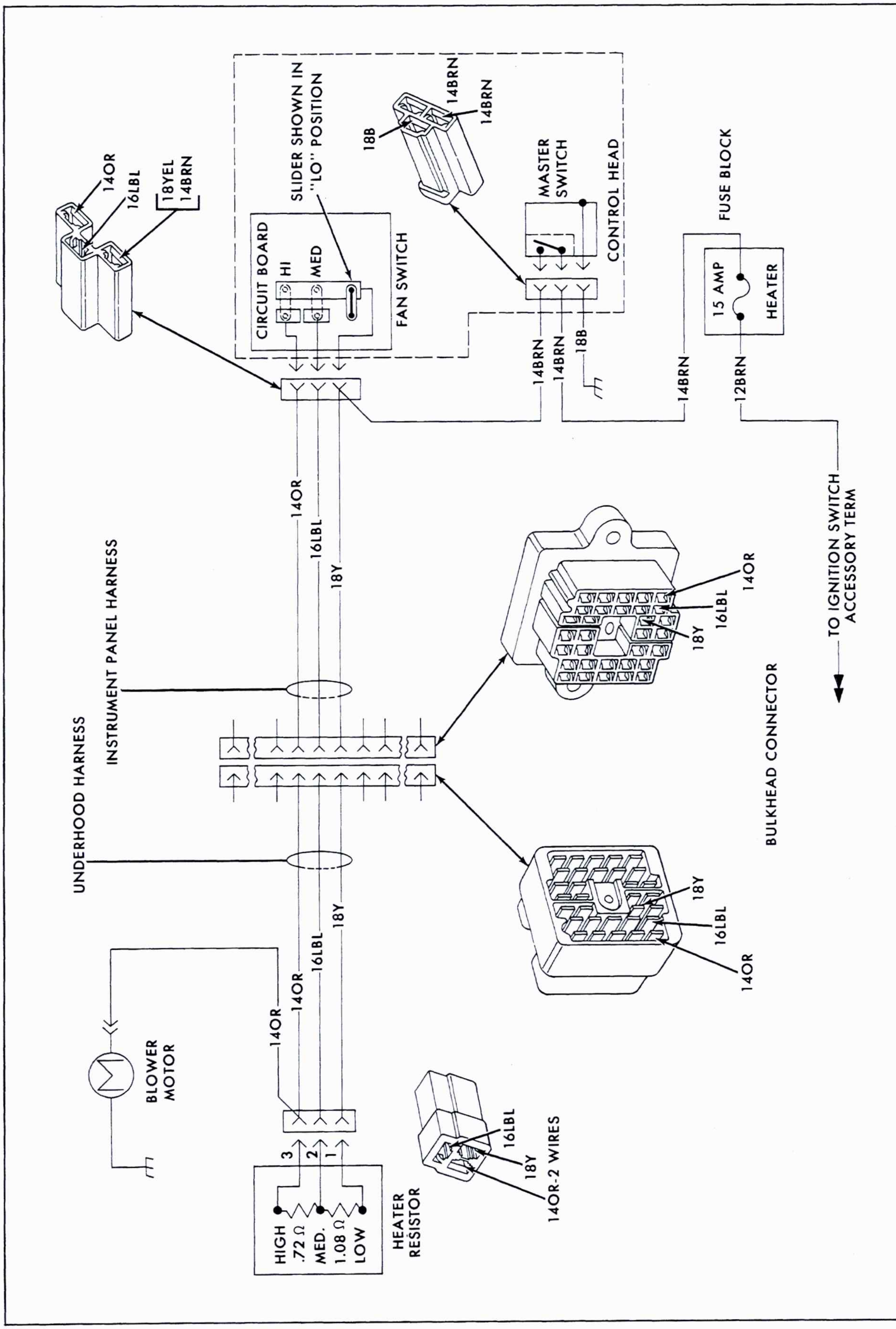


Fig. 1-81 Heater Electrical Circuit Diagram

4. Remove heater hoses from fittings on heater-blower assembly.
5. Disconnect green vacuum hose at vacuum power unit.
6. Disconnect bowden cable to temperature valve at pivot point on heater-blower assembly and remove screw securing cable clamp to assembly.
7. Remove screw securing check valve to assembly and position check valve with hoses attached out of way.
8. Remove screw securing power brake vacuum hose clamp to assembly and position hose out of way.
9. Disconnect three way connector at blower resistor on heater-blower assembly.
10. If car is equipped with seat warmer, remove three screws securing seat warmer relay to assembly and position relay out of way.
11. Remove wiring harnesses from clip on heater blower assembly.
12. Remove seven screws securing bottom of heater-blower assembly to cowl.
13. Remove five screws and one nut securing top of heater-blower assembly to cowl and remove heater-blower assembly.

b. Installation

1. Position heater-blower assembly to cowl and install one screw and one nut, on either end, securing top of assembly to cowl. Tighten finger tight.
2. Reposition heater-blower assembly, if necessary, and install seven screws securing bottom of assembly to cowl.
3. Install four remaining screws securing top of assembly to cowl, and tighten screws previously installed.
4. Connect heater hoses to fittings on assembly and secure with clamps.
5. If car is equipped with seat warmer, secure seat warmer relay to assembly with three screws.
6. Secure three-way connector at blower resistor on heater-blower assembly.
7. Position check valve on assembly and secure with one screw.
8. Secure power brake vacuum hose clamp to assembly with one screw.
9. Install bowden cable to temperature valve at pivot point on assembly, and install screw securing cable clamp to assembly. Adjust cable as described in Note 1a.
10. Install wiring harnesses in clip on heater-blower assembly.
11. Connect green vacuum hose at vacuum power unit.
12. Install blower motor as described in Note 50b.
13. Fill cooling system.
14. Connect negative battery cable.

52. Heater Core

a. Removal

1. Remove heater-blower assembly as described in Note 51a.
2. Remove four screws, two each side of heater core, securing wire retaining clamps to heater-blower case, and remove retaining clamps.
3. Pull heater core out of heater-blower case, and remove rubber grommets from inlet and outlet fittings.

b. Installation

1. Install rubber grommets on heater core inlet and outlet fittings and position heater core inside of heater-blower case.
2. Position rubber grommets around heater core inlet and outlet fittings where fittings protrude through heater-blower case.
3. Position wire retainer clamps over heater core ends and secure to heater-blower case using four screws, two per retaining clamp.
4. Install heater-blower assembly as described in Note 51b using sealer.

DESCRIPTION AND SERVICE INFORMATION FLEETWOOD SEVENTY-FIVE AIR CONDITIONER

Two separate air conditioning systems are employed in the Fleetwood Seventy-Five Cadillac. In each system automatic temperature control is provided. The front compartment system utilizes the same components and operates in the same manner as the series 680-1-2-3 air conditioner, with the following exceptions:

1. A smaller blower motor is employed in the front evaporator assembly.
2. Higher value resistors are used in the front power servo assembly to match the smaller blower motor.
3. A "Vent" position is not provided on the front control panel.
4. The front system refrigerant and heater water hoses have "tee" connections incorporated to provide feed to the rear system.

The rear compartment system utilizes a series-flow, reheat-type evaporator, heater and blower assembly, located on the axle kickup shelf in the trunk compartment. This assembly draws car interior air from the rear compartment through the package shelf and outside air from scoops on the outside of the body, cools and reheats it as required, and discharges it into the passenger compartment through overhead roof ducts or through duct-work and grilles in the rear doors. When the system operates in heater

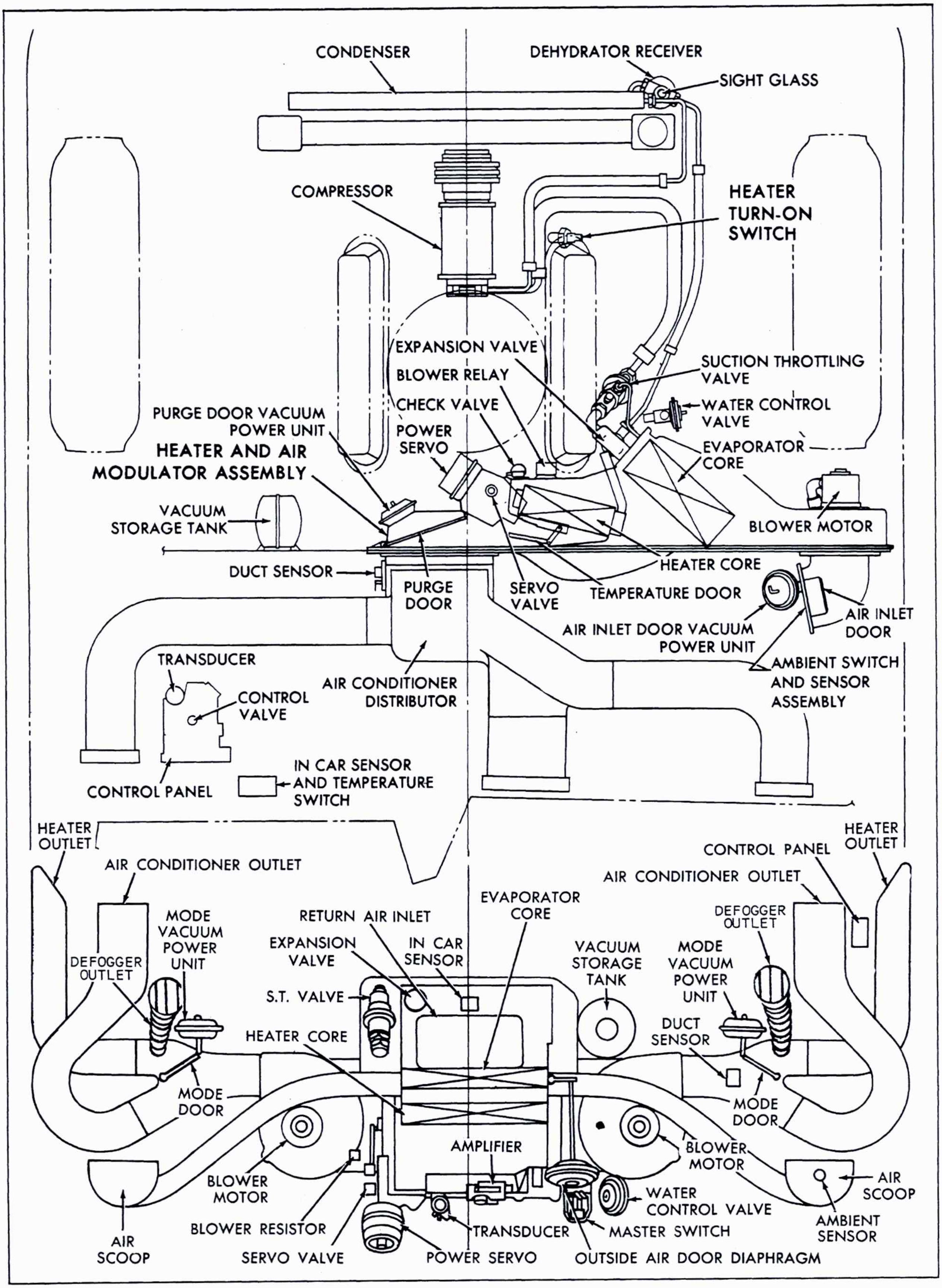


Fig. 1-82 Location of 697 A/C Units

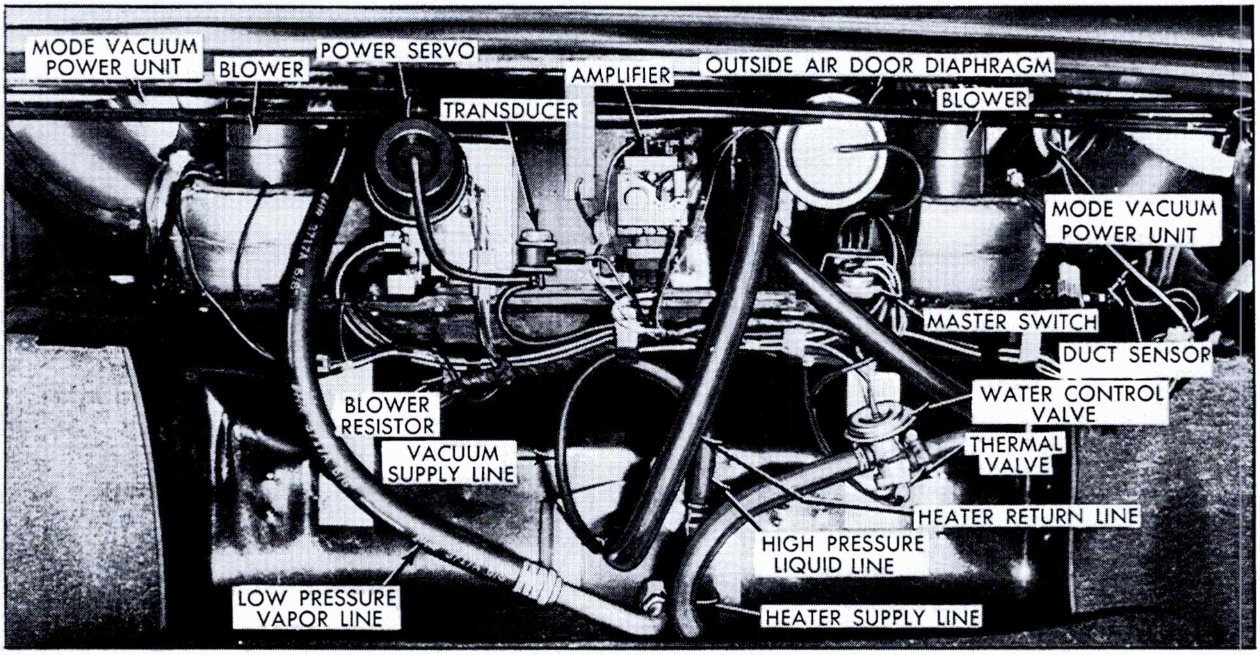


Fig. 1-83 Rear Unit on Car

mode, a portion of the heated air is directed at the rear window through grilles in the package shelf for defrosting purposes.

A complete string of sensors, an amplifier, a transducer, a power servo and other temperature control components similar to those employed in the front system are utilized in the rear system. A description of these follows.

Automatic Climate Control Components (697 Rear) (Fig. 1-82 and Fig. 1-83)

a. Sensors

The in-car sensor, mounted in a grille located on the rear package shelf, senses the temperature of the passenger compartment as well as the sun load on the rear of car.

The duct sensor senses the discharge air temperature. It is located in the mode door assembly on the right side of the car where it is exposed to all discharge air entering this area.

The ambient sensor is located in the right air intake scoop outside of the car. It senses the temperature of the ambient air entering the system.

b. Temperature Dial

The temperature dial is located in the right rear arm rest. The dial is graduated in 5° F divisions to allow the passenger to select any temperature in the 65°F to 85°F range.

c. Vacuum On-Off Switch

The Vacuum On-Off switch is located in the right rear arm rest behind the temperature dial. This switch allows the passenger to turn the rear system off.

d. Amplifier

The amplifier is mounted on the rear face of the rear unit case assembly in the trunk. The rear amplifier operates in the same manner as the one used in the front system.

e. Transducer

The transducer for the rear assembly is mounted on the rear face of the case assembly just to the left of the amplifier.

f. Power Servo

The power servo is mounted on the left vertical surface of the case assembly.

Suction Throttling Valve (Fig. 1-10) (697 Rear)

The pilot operated absolute suction throttling valve is located on the left front side of the evaporator assembly, in the low pressure line to the compressor. The valve body contains two ports; the evaporator gage port on the inlet side of the valve, and a port on the outlet side for the external equalizer line.

This valve works in the same manner as that used on front systems, but is calibrated to control the rear evaporator pressure to 27 psi.

Expansion Valve (697 Rear)

An expansion valve is used in the rear system to perform the same function as the valve used in the front system. The rear expansion valve is contained within the evaporator case on the lower left front side.

Evaporator (697 Rear)

The evaporator used on the rear system is smaller and of different construction than that used in front systems. The rear evaporator is located in the case assembly in the luggage compartment under the package shelf.

Blower Assemblies (697 Rear)

Two blower assemblies are used on the rear system. Air from the heater air conditioner assembly is drawn into blower assemblies on either side of the case and then expelled into the car.

Control Panel (697 Rear)

The control panel, located in the right rear arm rest, consists of a temperature dial and an ON-OFF switch. The temperature dial is graduated in 5 degree divisions from 65°F to 85°F. This dial is used to select the desired temperature. The ON-OFF switch controls vacuum feed to the rear system and is used to turn the system On or Off.

Vacuum Circuit

The Automatic Climate Control system incorporates two basic vacuum circuits. The first circuit controls the position of the power servo unit, and the second circuit controls the operation of the various vacuum operated components of the system.

Vacuum flows from the engine through the vacuum storage tank to the transducer. The vacuum, now regulated by the transducer, then flows to the power servo unit.

The second vacuum circuit flows from the engine through the check valve to the On-Off switch and from there to the servo vacuum valve. To trace the path of the vacuum, refer to the servo valve connections, Fig. 1-84 and to Fig. 1-85.

Operation

a. Off

NOTE: For the purpose of this discussion, assume the control switch is in the Off position, and the engine is running.

Whenever the engine is operating, the sensor string is transmitting a signal to the amplifier. The signal is converted to a proportionate DC voltage by the amplifier, and is fed to the transducer. The transducer converts the electrical signal to a proportionate regulated vacuum output that is supplied to the vacuum power unit of the power servo, thus placing the power servo unit in the proper operating position, if the system were to be started.

b. Maximum Cooling

NOTE: For the purpose of this discussion: assume the ambient air temperature is 90°F, the in-car temperature is 90°F, the temperature dial rheostat is set at 75°F, and the engine is running.

Due to the high temperatures acting on the sensors, the resistance values of the sensors will be low, causing a strong signal to the amplifier. The output of the amplifier is high, and is being fed to the transducer, where it is converted to a weak vacuum output, causing the power servo to be in the maximum air conditioning position.

When the switch is placed in the "ON" position, vacuum is fed to the master switch, completing the electrical circuit to the blower motor and compressor, and to the servo vacuum valve. In the maximum air conditioning position, the servo valve performs the following vacuum functions:

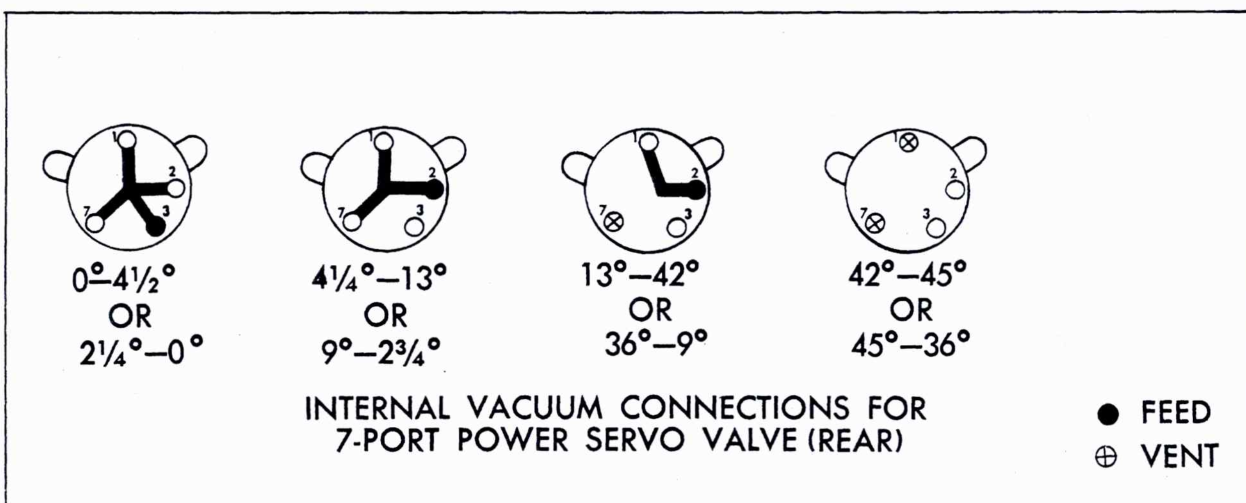


Fig. 1-84 Rear Rotary Vacuum Valve Internal Connections

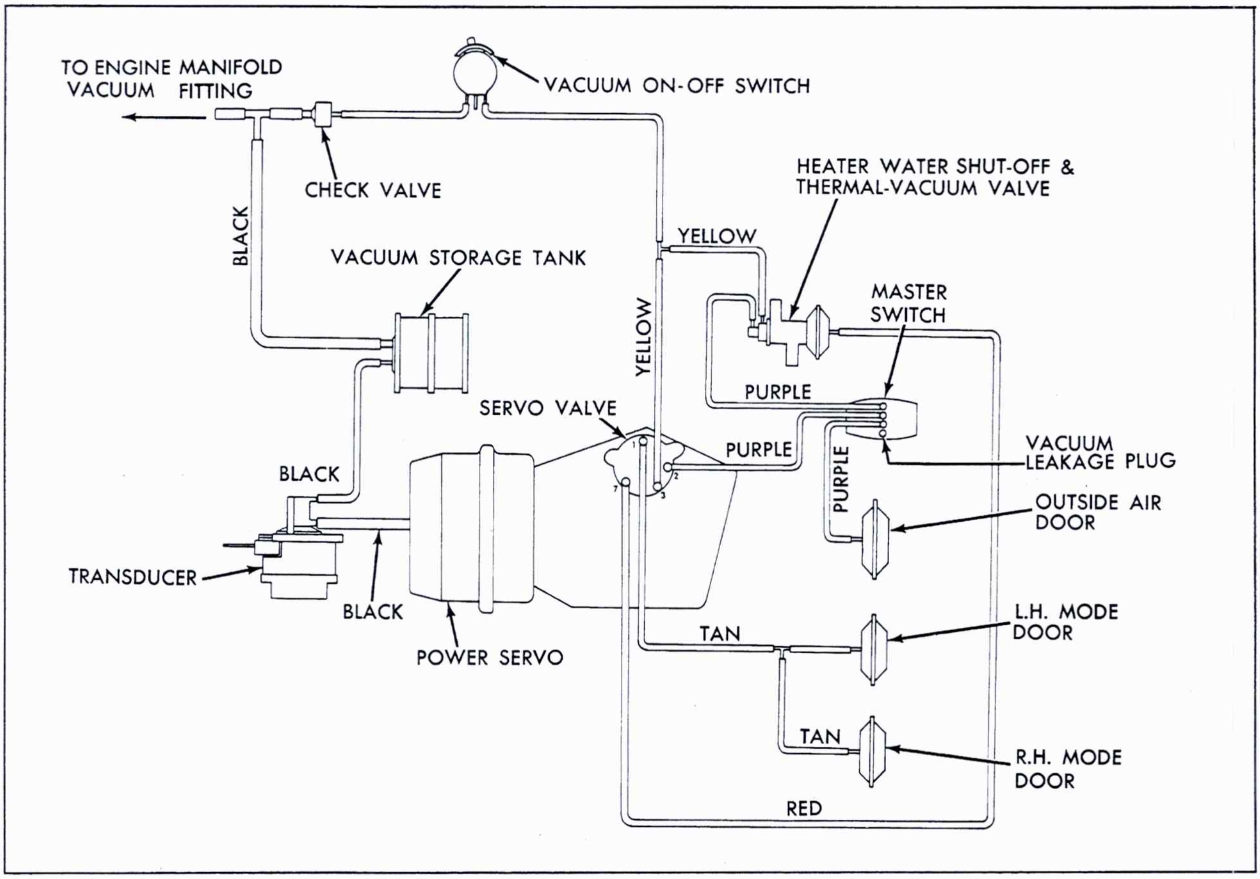


Fig. 1-85 Automatic Climate Control Vacuum Schematic - Rear Unit

The mode doors are moved to the air conditioning position, allowing the discharge air to be discharged through the air conditioner outlets. The water control valve is closed, preventing the flow of engine coolant to the heater core.

In addition, the power servo has placed the temperature door in the maximum cooling position, preventing any air flow through the heater core. The blower is operating at HIGH speed. Because of its connection at the master switch, the outside air door is opened, admitting outside air into the system.

As the system operates the in-car and duct sensors, sensing the lowering temperatures, increase in resistance, causing more vacuum to be fed to the power servo unit. The power servo then performs the necessary events, in the proper sequence, Fig. 1-86, until such time as the system reaches a balanced position to hold the interior temperature to the dial setting.

As the vacuum supplied to the power servo vacuum power unit increases, the position of the operating arm and the servo vacuum valve changes. The blower decreases to M2 speed. Vacuum to the hot water valve is cut off, causing the hot water valve to pass engine coolant.

As the system continues to modulate, the blower will decrease to M1 speed and then the position of the temperature door will change to allow the entry of heated air that will mix with the cooled air. Continued modulation by the system can decrease the blower to LOW speed. The system will modulate itself to maintain the interior temperature, regardless of any change in the ambient air temperature.

If the ambient air temperature were to fall quite rapidly, the ambient sensor resistance value would increase, causing a weaker voltage signal to be sent to the transducer. The power servo unit would move towards the heater position as the vacuum output from the transducer was increased. The system would switch into the heater mode and the blower speed would increase to

Power Servo Arm Angle		Event
Increasing Vacuum	Decreasing Vacuum	
4-1/4°	2-3/4°	A/C Over Ride Begin - End
13°	9°	Water Control Valve Close - Open
42°	36°	Change Mode A/C - Heat

Fig. 1-86 Sequence of Events Rear Unit

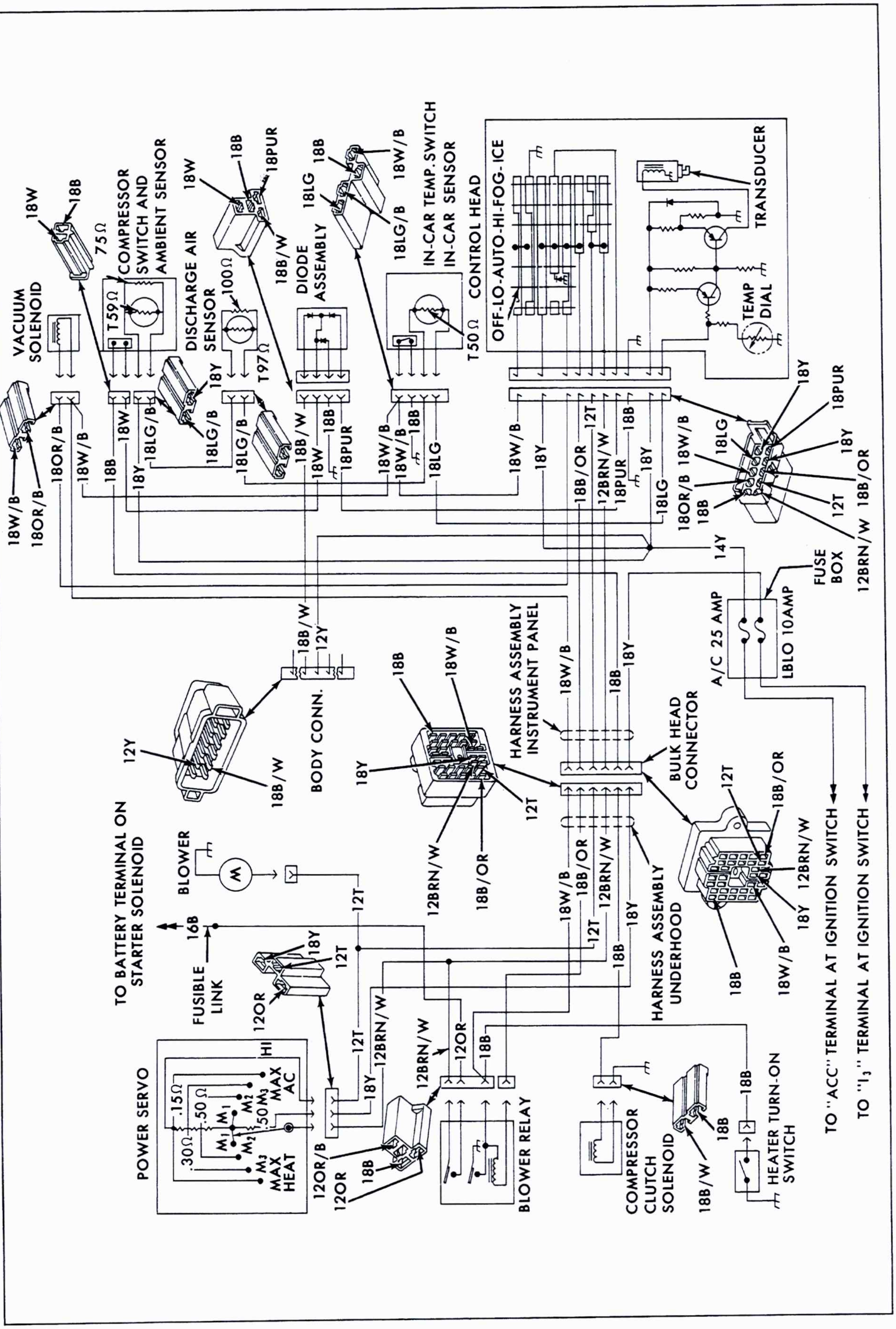


Fig. 1-87 Automatic Climate Control Circuit Diagram - 697 Series

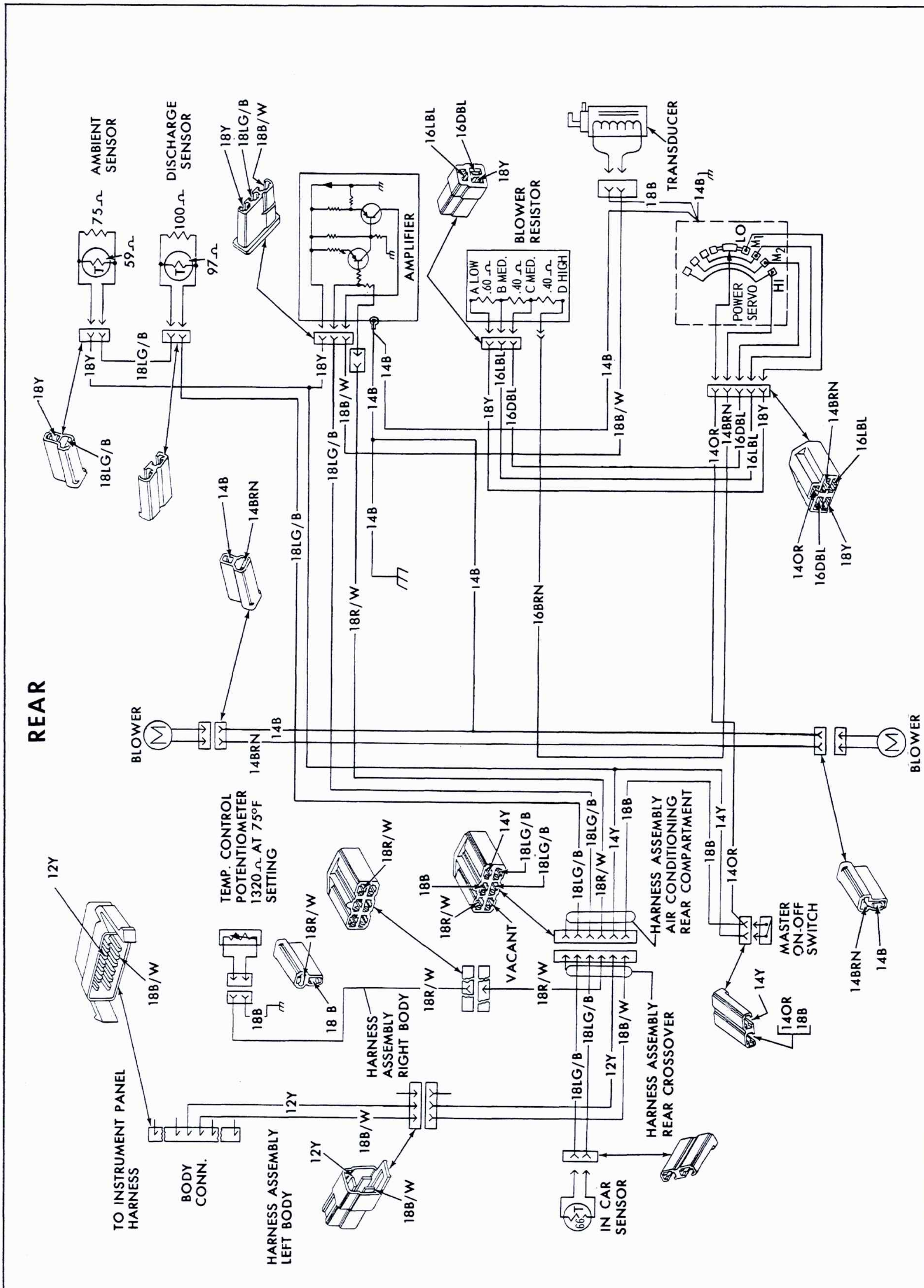


Fig. 1-87 Automatic Climate Control Circuit Diagram - 697 Series

M1, then M2, and HIGH. During the increase of blower speeds, the temperature door would be traveling toward the maximum heat position and eventually would prevent all cold air from entering the system.

c. Maximum Heat

NOTE: For the purpose of this discussion, assume the ambient air temperature is 0°F, the in-car temperature is 0°F, the temperature dial is set at 75°F, and the engine is running.

Due to the low temperatures acting on the sensors, their resistance values will be high, causing a weak signal to the amplifier. The output of the amplifier is low, and is being fed to the transducer, where it is converted to a strong vacuum output causing the power servo to move toward the maximum heat position.

In the heat mode, the vacuum circuitry is such that the vacuum must pass through the thermal vacuum valve in order to actuate the master switch. The compressor clutch circuit is held open by the ambient switch in the front unit any time it is below 32°F.

Once the engine coolant has reached the temperature of approximately 140°F, vacuum flows through the thermal vacuum valve, causing the outside air door to open and the blower to operate at HIGH speed, admitting heated air into the car. The in-car and duct sensors sense the temperature rise and, as their resistance values lower, the system begins to modulate and the blower speeds will diminish to M2, M1 and then to LOW. During the decrease in blower speeds, the temperature door would travel from the maximum heat position to a mid-position, blending heated and cooled air. If the outside air temperature were to rise to about 35°F, the compressor clutch circuit would close, causing compressor operation to begin. Continued temperature increases, sensed by the sensors, cause the system to move toward the air conditioning position.

Electrical Circuit (Fig. 1-87)

The Automatic Climate Control electrical circuit flows from the accessory terminal of the ignition switch to the 25 ampere fuse in the fuse block, and then to the amplifier, to the ambient sensor, and to the master switch.

The master switch sends current through the diode assembly, mounted behind the instrument panel to energize the compressor clutch when the front unit ambient switch is closed. A compressor diode assembly is incorporated into the compressor circuit of the front and rear units on the Fleetwood Seventy-Five systems. The compressor diode assembly permits the master switch of either unit to supply current to the compressor clutch without causing a feed back into the other system. A feed back from one system into the other would cause the master switch of that unit to be overridden and the system's blower to operate even though the system was turned off. The compressor diode assembly is mounted on an instrument panel molding stud to the right of the radio in the dash panel.

The sensor string circuit current flows from the ambient sensor to the discharge air sensor, to the in-car sensor, and then to the amplifier.

53. Adjustments (697 Rear)

a. Temperature Door Link

1. Loosen temperature door adjusting link screw.
2. Apply vacuum to power servo vacuum power unit.
3. Tighten temperature door adjusting link until head of screw contacts link then continue to tighten just enough to take play out of link.

b. Temperature Dial

NOTE: If system is working properly, perform temperature dial test as described in Notes 56a, step 6, 56b, step 7, or 56c.

Although the temperature dial may be operating correctly, it may be necessary to change the temperature dial setting for customer satisfaction. If an owner indicates a particular temperature dial setting where he is most comfortable, set temperature dial to that setting and proceed as follows:

1. Insert Temperature Dial Adjuster, J-21530, between temperature dial and casting, Fig. 1-88.
2. Turn dial to proper setting as determined by test procedure used.

54. Performance Test (697 Only)

To determine the efficiency of the Fleetwood Seventy-Five Air Conditioning system, run a performance test as outlined below:

1. Place transmission in PARK and start engine.
2. Check operation of controls by rotating temperature dials from stop to stop.
3. Turn off engine.
4. Purge high and low pressure lines on Charging Station J-8393.
5. Connect Charging Station high pressure line to fitting on high pressure vapor line, and low pressure line to evaporator gage fitting on suction throttling valve.
6. Disconnect vacuum hoses from both power servo vacuum power units and plug hoses.
7. Close hood as far as possible without pinching lines.
8. Place auxiliary fan (approximately 24 inch dia. blades) thirty inches from front bumper and direct air stream to center of radiator grille.

NOTE: Volume must be sufficient to obtain proper head and return pressures.

9. Place thermometer in air stream between

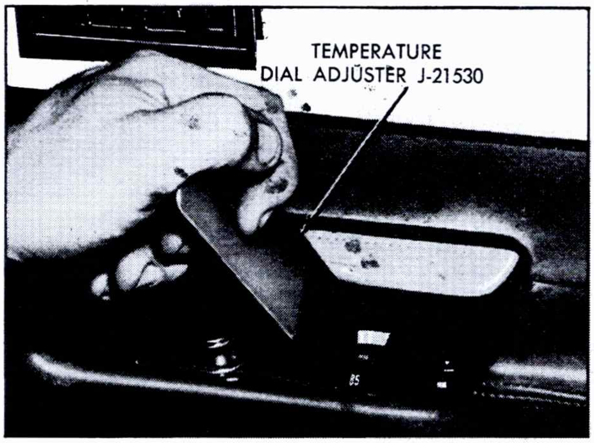


Fig. 1-88 Adjusting Rear Temperature Dial

auxiliary fan and radiator grille. Thermometer bulb must not contact any metal.

10. Place another thermometer in right front air conditioning outlet grille. Thermometer bulb must not contact any metal.

11. Open all doors and windows.

12. Use Humidicator, J-6076, to obtain simultaneous temperature and relative humidity readings of air entering air intake grille as follows:

a. Shake thermometer down to settle red and blue columns in bottom of tubes.

b. Thoroughly moisten wick on blue thermometer with water.

c. Place humidicator on right hand side of cowl air intake grille so that entering air passes over bulbs of thermometer.

13. Place thermometer in right rear roof outlet and open deflector doors.

14. Place another thermometer on center of package shelf over return air intake.

15. Turn on auxiliary fan.

16. With transmission in PARK start engine and operate at 2,000 rpm.

17. After five minutes, record:

a. Humidicator red and blue bulb readings. (Red bulb reading is temperature of air entering air intake grille.)

b. Temperature of air being discharged through right front air conditioning outlet.

c. Temperature of air entering grille.

d. Head pressure.

e. Front evaporator pressure.

f. Temperature of air being discharged from right rear outlet.

g. Temperature of air returning to rear evaporator assembly.

18. Turn off engine and auxiliary fan.

19. To determine relative humidity of air entering air intake grille, position inner scale of humidicator so that blue (wet bulb) temperature is opposite red (dry bulb) temperature. Relative humidity is indicated by humidity arrow. Record relative humidity.

20. Refer to Chart C, Fig. 1-89, to determine if outlet air temperatures are normal. If outlet temperatures are the same or below reading on chart, operation is normal.

21. Refer to Chart D, Fig. 1-89, to determine if head pressure is normal. If head pressure is within 30 pounds below reading on chart, operation is normal.

22. Disconnect Charging Station.

23. Install vacuum hose on power servo vacuum power units after unplugging.

55. Connecting Automatic Climate Control Tester

The Automatic Climate Control Tester, J-21512, and the Automatic Temperature Control Tester, J-22368-01, are used to isolate an electrical malfunction in the Automatic Climate Control system by serving as a substitute for components of the system. To use:

1. Remove trim panel inside luggage compartment.

2. Disconnect three-way connector from the amplifier.

3. Connect three-way electrical connector of tester -- the one with three female terminals -- to amplifier terminal.

4. Connect second multiple connector of tester to car wiring harness.

5. Connect ground lead to car body.

6. When using J-22368-01, disconnect large vacuum hose at transducer and insert tester tee in vacuum line.

56. Testing Automatic Climate Control System

Two testers are available to perform these tests. Due to differences between the testers, two procedures are given in this note. Follow the test procedure that applies to the tester to be used.

a. Automatic Climate Control Tester, J-21512

This procedure is designed to assist servicemen in locating a malfunction in the Automatic Climate Control system, when the system turns ON, but operates only in maximum heat or maximum air conditioner at high blower speed. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 6. If system still performs incorrectly, proceed as follows:

NOTE: For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place transmission in PARK and start engine.

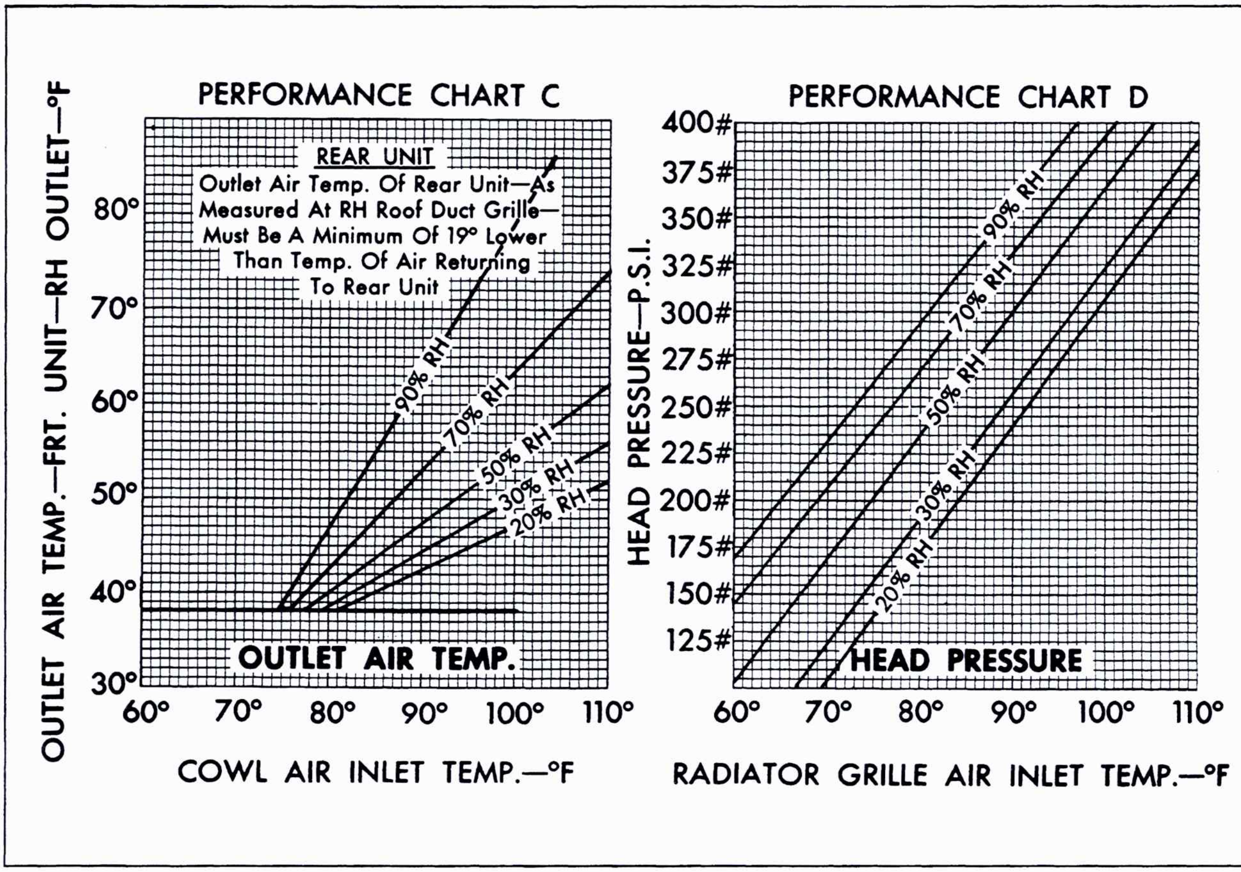


Fig. 1-89 Air Conditioner Performance Chart - 697 Series

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in stops b and c, proceed to step 2.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 5.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

2. Sensor String Test

a. Turn engine off if still operating, and connect Automatic Climate Control Tester, J-21512, as described in Note 55.

b. Set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position.

e. Place Sensor switch to A/C position. System and tester meter should go to full air conditioning.

f. Place Sensor switch in HTR position. System and tester meter should go to full heater.

g. If system did not perform correctly in steps e and f, proceed to step 3.

h. If system performed correctly, disonnect Automatic Climate Control Tester and reconnect car wiring harness. Visually inspect in-car sensor, replace if apparently defective, and check operation of system.

i. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

j. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-13. Replace any defective sensor located. If no defective sensor is found, check car wiring.

k. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

3. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place Amplifier switch on Automatic Climate Tester, J-21212, in AMPLIFIER position.

b. Turn Amplifier Control counterclockwise to stop. System and tester meter should go to full air conditioning.

c. Turn Amplifier Control clockwise to stop. System and tester meter should go to full heater.

NOTE: If tester meter does not vary with variation in Amplifier Control, transducer, or electrical circuit to transducer, is defective.

d. If steps b and c do not result in correct system operation, proceed to step 4.

e. If system operated properly in steps b and c, disconnect Automatic Climate Control Tester and reconnect car wiring harness to amplifier.

f. Disconnect red wire from temperature dial rheostat terminal on amplifier. With wire open, system should go to full air conditioning.

g. Ground red wire. System should go to full heat.

h. If system performed properly in steps f and g replace termperature dial rheostat.

i. If system failed to perform properly in steps f and g, replace amplifier circuit board.

j. If system fails to work properly after replacing amplifier circuit board, check car wiring.

4. Regulated Vacuum Test

NOTE: Automatic Climate Control Tester, J-21512, should still be plugged in and engine should be running.

a. Connect a vacuum gage to transducer vacuum input hose. Gage should read above 14 inch Hg. If not, locate and correct vacuum failure.

b. Reconnect vacuum input hose and connect vacuum gage to transducer output fitting, using a length of vacuum hose.

c. Make certain that temperature dial is at 71° setting.

d. Place Amplifier switch on Automatic Climate Control Tester, J-21512, in SENSOR position. Turn sensor switch to MID position and rotate temperature dial until tester meter needle reads on set line. Vacuum gage should read between 3.5 inch Hg. and 7.2 inch Hg. If not, replace transducer.

e. Rotate temperature dial to 65° setting. Vacuum gage should read 1.5 inch Hg. or less. If vacuum reading is higher , turn Sensor switch to A/C position, gage should now read 1.5 inch Hg. or less. If not, replace transducer.

f. Repeat step d.

g. Rotate temperature dial to 85° setting, vacuum gage should read 10 inch Hg. or more. If vacuum reading is lower ,turn Sensor switch to HTR position, gage should now read 10 inch Hg. or more. If not, replace transducer. Check car wiring.

h. Rotate temperature dial to 71° setting and place Amplifier switch in AMPLIFIER position. Rotate tester Amplifier control from stop to stop. Output of transducer should vary between 1.5 inch Hg. or less, to 10 inch Hg. or more within 10 seconds. If not, replace transducer.

5. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 71° and start engine. Vacuum gage should read above 14 inch Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-84 and 1-85 determine what valves, hoses and vacuum power units are involved to locate leak.

6. Temperature Dial Test with Automatic Climate Control Tester, J-21512.

NOTE: This test can be made only when the system is operating properly.

a. Place Amplifier switch in SENSOR position.

b. Place Sensor switch in MID position.

c. Adjust temperature dial until tester meter reads on SET line. Temperature dial should read 71°.

d. If temperature dial does not read 71°, adjust dial as described in Note 53b.

7. Shut off engine and remove Automatic Climate Control Tester from system and connect car wiring harness to amplifier connector.

8. Intermittent Conditions

a. Connect the positive lead of an accurate voltmeter to the transducer wire at the transducer connector. Ground the negative lead to the car body.

b. Allow system to operate and stabilize.

c. Tap the sensors, temperature dial and amplifier. A severe rap is necessary. Jiggle wires to the various units.

d. Watch the voltmeter for any sharp variation in the meter reading. Note the operation of the system.

e. If a variation occurs when a unit is tapped, check that unit for weak connections. Repair connections as necessary.

b. Automatic Temperature Control Tester, J-22368-01

This procedure is designed to assist servicemen in locating a malfunction in the Automatic

Climate Control system. If the system is operating incorrectly, but does have some degree of self-modulation, first check adjustment of temperature dial as described in step 7. If system still performs incorrectly, proceed with listed tests.

For positive results, the Automatic Climate Control system should be tested in an area where the ambient temperature is between 70°F and 80°F. If the ambient temperature is below 70°F, the system may not produce full air conditioning, or if above 80°F, the system may not produce full heat.

1. Preliminary Test

a. Place Transmission in PARK and start engine.

b. Disconnect vacuum hose from power servo vacuum power unit, and seal hose with thumb. System and power servo should go to full air conditioning.

c. Connect a vacuum hose from vacuum supply line to power servo vacuum power unit. System and power servo should go to full heat. Reinstall vacuum hoses.

d. If system and power servo performed properly in steps b and c, proceed to step 3.

e. If power servo performed properly, but system did not, in steps b and c, proceed to step 6.

f. If power servo and system failed to perform properly, proceed to step g.

g. Check power servo and temperature door for binding or other mechanical interference. If no mechanical interference is found, replace power servo unit.

h. If system failed to turn on, proceed to step 2.

2. Source Test

a. Turn off engine if still operating and connect Automatic Temperature Control Tester, J-22368-01, as described in Note 55.

b. Turn system ON and set temperature dial to 71° setting.

c. With transmission in PARK position, start engine.

d. Place rocker switch on Automatic Temperature Control Tester, J-22368-01 in MANUAL position.

e. Turn voltage knob to SOURCE position.

f. Set manual control knob to 150 position.

g. Tester meter should read battery voltage.

h. If meter does not read battery voltage, check the power supply wires for shorts, grounds or opens. Check for blown fuse. The tester may be used for checking the wiring by turning the voltage knob to the PROBE position and using the red probe.

i. If meter read battery voltage in step g, proceed to step 3.

3. Sensor String Test (Opens)

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to SENSOR position.

c. Set manual control knob to 150 position.

d. Tester meter should read battery voltage.

e. If meter read battery voltage in step d, proceed to step 4.

f. If meter did not read battery voltage in step d, visually inspect in-car sensor, replace if apparently defective, and check operation of system.

g. Check for loose connector at duct sensor and then at ambient sensor. If loose connector is found, repair and check operation of system.

h. If an ohmmeter is available, measure resistance value of ambient sensor, duct sensor and then in-car sensor. Sensor resistance value should approximate resistance value given in Fig. 1-13. Replace any defective sensor located. If no defective sensor is found, check car wiring.

i. If an ohmmeter is not available, substitute a known good ambient sensor, duct sensor, and then in-car sensor; check operation of system after each substitution. If system still fails to perform satisfactorily, check car wiring.

4. Amplifier Test

CAUTION: Sensor string must be tested before testing amplifier.

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Turn manual control to MAX. HEAT position.

d. Meter should read from 0 to 4 volts.

e. Turn manual control to MAX. COLD position.

f. Meter should read 8 volts minimum.

g. If steps c through f do not result in correct readings, proceed to step i.

h. If proper readings were achieved in steps c through f, proceed to step 5.

i. Disconnect red wire from temperature dial rheostat terminal. With wire open, system should go to full air conditioning. Meter should read 8 volts minimum.

j. Ground red wire. System should go to full heat, meter should read 0-4 volts.

k. If system performed properly in steps i and j, replace temperature dial rheostat.

l. If system failed to perform properly in steps i and j, replace amplifier circuit board.

m. If system fails to work properly after replacing amplifier circuit board, check car wiring.

5. Transducer Test

a. Place rocker switch in MANUAL position.

b. Turn voltage knob to TRANSDUCER position.

c. Turn manual control to MAX. COLD position.

d. Tester meter should read 8 volts minimum and vacuum gage should read 0-3 inches vacuum. Maximum blower should be achieved.

e. Turn manual control to MAX. HEAT position.

f. Tester meter should read 0-4 volts and vacuum gage should read 9 inches minimum vacuum. Maximum blower should be achieved.

g. If proper readings are not obtained in steps c through f, check wiring to transducer circuit for shorts, grounds or opens. Check for improperly grounded transducer. Replace transducer.

6. System Vacuum Test

a. Tee in a vacuum gage to any nipple of the master switch, and position vacuum gage so that it can be read from the seat.

b. Set the temperature dial to 70° and start engine. Vacuum gage should read above 14 inch

Hg. at idle and stay at this setting throughout the check.

c. Slowly rotate temperature dial to 85°, and then back to 65°. If the temperature dial is rotated too rapidly, the vacuum may drop to 9 inch Hg. or so, but it should return to the original setting. This is a normal condition. However, if a vacuum leak is present, the vacuum reading will drop to 6 inch Hg. or less and remain there.

NOTE: It is possible that a vacuum leak may show up only at a particular setting of the temperature dial. Therefore, whenever the vacuum drops, immediately stop rotating the dial until you are certain whether a leak is present or whether you were turning the dial too fast.

d. Rotate temperature dial back to 71° setting. Vacuum reading should always be above 14 inch Hg., except in OFF position, where there should be no vacuum reading.

e. If a vacuum leak is present, determine when it is present. Then, referring to Figs. 1-84 and 1-85, determine what valves, hoses and vacuum power units are involved to locate leak.

7. Temperature Dial Test with Automatic Temperature Control Tester, J-22368-01.

a. Place rocker switch in MANUAL position.

b. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

c. Set manual control to 138 position.

d. Rotate temperature dial until tester meter indicates 6.5 volts.

e. Temperature dial should indicate 75°F.

f. If temperature dial does not indicate proper setting, adjust temperature dial as indicated in Note 53b.

8. Operational Test (697 ONLY)

a. This procedure is to be used when testing the rear system on the Fleetwood Seventy-Five. The tester should be connected to the system as described in Note 55 for rear system. Both systems should be turned ON, the front system should be operating in AUTO. The temperature dials should be set at 75°.

b. Position rocker switch in AUTOMATIC position.

c. Set voltage knob to AMPLIFIER OR CONTROL CAL. position.

d. Set manual control to 150 position.

e. Allow five minutes for systems to stabilize with doors and windows closed.

f. Meter should read 5.5 - 7.5 volts.

g. If improper reading is obtained in step f, check for shorted sensor.

h. If proper reading is achieved in step f, tap sensors and amplifier.

i. If meter needle jumps when a unit is tapped, check that unit for weak connections that will cause an intermittent defect in system.

j. If proper reading is achieved in step f, with no movement of the needle in step i and all steps in Note 56b, steps 1-7 have been completed, system is operating properly.

k. Shut off engine and remove Automatic Temperature Control Tester, J-22368-01 from system. Connect car wiring harness connector to amplifier connector and large vacuum hose to transducer. Install any trim items removed.

c. Temperature Dial Operational Test

NOTE: This test is performed without the Automatic Temperature Control Tester, J-22368-01, or Automatic Climate Control Tester, J-21512. Although it is less efficient it allows for the tailoring of a system to meet the requirements of an individual owner.

a. Using masking tape, suspend a thermometer from headliner so that bulb hangs at breath level over front passenger's seat.

b. Suspend a second thermometer at breath level midway between the rear roof outlets.

c. Position auxiliary fan (approximately 24 inch dia. blades) so that air stream is directed across air intake grille.

d. Close all doors and windows.

e. Set both temperature dials to 75°.

f. With shift lever in PARK position, start engine and operate at 900 rpm.

g. Making certain that all air conditioner outlets are open, adjust as follows:

1. Front end outlets so that air is directed toward doors.
2. Front center outlet so air is directed toward top of front seat.
3. Rear roof outlet diverter doors should be opened.

CAUTION: Outlet air must not be directed toward thermometers.

h. Allow systems to operate for 25 minutes for stabilization, then record reading from suspended thermometers.

i. If thermometers vary from 75° setting, adjust temperature dials to coincide with nearest thermometer reading, as indicated in Note 53b.

57. Automatic Climate Control Panel (697 Rear)

a. Removal

1. Remove back seat cushion.
2. Pull down on center arm rest and remove two fabric retaining screws and two cap screws securing seat back to body braces.
3. Straighten retaining clips along bottom of seat back.
4. Pull out on bottom of seat back, lift seat back up and off top retaining brackets, and remove seat back.
5. Remove right seat back filler panel.
6. Remove right rear quarter window moldings.
7. Remove three screws at bottom of arm rest.
8. Remove power window switches and remove screw holding trim panel in place.
9. Remove trim panel and arm rest assembly.

b. Installation

1. Replace trim panel and arm rest assembly.
2. Secure trim panel with one screw and install power window switch.
3. Replace three screws at bottom of arm rest assembly.
4. Install right rear quarter window moldings.
5. Install seat back filler panel.
6. Position seat back to engage top retaining brackets and bend retaining clips over hooks along bottom of seat back.
7. Secure seat back to body brackets with two cap screws in area of center arm rest and replace arm rest fabric. Secure fabric with two screws.
8. Install back seat cushion.

58. Air Conditioner Control Panel Disassembly and Assembly

a. Temperature Dial Rheostat Removal

1. Remove control panel as described in Note 57a.
2. Disconnect electrical connector inside arm rest.
3. Remove two screws securing rheostat to control panel and remove rheostat.

b. Temperature Dial Rheostat Installation

1. Position rheostat to control panel and secure with two screws.
2. Connect electrical connector.
3. Install control panel as described in Note 57b.
4. Adjust temperature dial as described in Note 53b.

c. Control Switch Removal

1. Remove control panel as described in Note 57a.
2. Disconnect black and yellow hoses from control switch.
3. Remove two screws and remove switch.

d. Control Switch Installation

1. Position switch to control panel and secure with two screws.
2. Connect black and yellow hoses to ports as indicated by color coding dots on switch assembly.
3. Install control panel as described in Note 57b.

59. Amplifer (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from amplifier terminals.
3. Disconnect red wire at single connector.
4. Remove spring clip securing multiple connector to mounting plate.
5. Remove screw securing amplifier circuit board to mounting plate.

b. Installation

1. Position amplifier circuit board to mounting plate and install screw securing circuit board to mounting plate.
2. Install spring clip securing multiple connector to mounting plate.
3. Connect red wire at single connector.
4. Connect multiple connector to amplifier terminals.
5. Install trim panel inside luggage compartment.

60. In-Car Sensor (697 Rear)

a. Removal

1. Snap protective grille off in-car sensor on package shelf inside car.
2. Remove two screws securing sensor to package shelf.
3. Disconnect in-car sensor from electrical connector.
4. Carefully remove in-car sensor.

b. Installation

1. Connect in-car sensor to electrical connector.
2. Position in-car sensor on package shelf.
3. Secure in-car sensor to package shelf with two screws.
4. Snap protective grille over in-car sensor on package shelf.

61. Ambient Sensor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect electrical connector.
3. Disconnect ambient air hose from right air scoop.
4. Remove four nuts securing air scoop to body.
5. Lift air scoop from car body and remove rubber gasket from bottom of air scoop.
6. Remove two screws securing grille to air scoop and remove grille.
7. Remove two screws securing ambient sensor to air scoop and remove sensor.

b. Installation

1. Position sensor to air scoop and secure with two screws.
2. Secure grille to air scoop with two screws and position gasket on bottom of air scoop.
3. Position air scoop on body and secure with four nuts.
4. Connect electrical connector.

5. Connect ambient air hose to air scoop.
6. Replace trim panel in luggage compartment.

62. Duct Sensor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect electrical connector from sensor terminals.
3. Remove two screws securing sensor to right mode door assembly and remove sensor.

b. Installation

1. Position sensor to right mode door assembly and secure with two screws.
2. Connect electrical connector to sensor terminals.
3. Install trim panel inside luggage compartment.

63. Water Control Valve (697 Rear)

NOTE: The water control valve and thermal vacuum valve are serviced as an assembly. Front and rear water control valves are not interchangeable. Rear valves may be identified by a RED ring on vacuum actuator.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Pinch off valve inlet and outlet water hoses.
3. Position shallow pan under water control valve to catch any coolant that may spill.
4. Remove clamps securing hoses to valve, and remove water hoses.
5. Remove vacuum hoses from thermal vacuum valve, and remove vacuum hose from water control valve vacuum power unit.
6, Remove horseshoe spring retainer clip securing valve to mounting bracket and remove valve.

b. Installation

1. Position water control valve to mounting bracket and secure with horseshoe spring retainer clip.
2. Install water hoses on valve inlet and outlet fittings and install clamps on hoses.
3. Remove clamps pinching off hoses.
4. Install vacuum hoses on thermal vacuum valve.

NOTE: Yellow striped hose connects to vacuum nipple closest to water outlet fitting.

5. Connect red striped vacuum hose to water control valve vacuum power unit.
6. Install trim panel inside luggage compartment.
7. Replace any coolant lost.

64. Blower Resistor (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove multiple connector from blower resistor.
3. Remove single connector from blower resistor.
4. Remove two screws securing blower resistor to bottom of case assembly.
5. Remove blower resistor from bottom of case assembly.

b. Installation

1. Position blower resistor into bottom of case assembly.
2. Secure resistor to case assembly with two screws.
3. Install single connector on blower resistor.
4. Install multiple connector on blower resistor.
5. Install trim panel inside luggage compartment.

65. Blower Motor Assemblies (697 Rear)

This procedure applies to both right and left blower motors.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect double connector at motor to be removed. Connector is located in front of motor.
3. Pull back rubber material from screw heads and remove five screws securing blower motor to blower housing.
4. Remove blower and fan assembly.

b. Installation

1. Position blower motor and fan assembly in blower housing and secure with five screws, and replace rubber insulating material.
2. Connect double connector.
3. Install trim panel inside luggage compartment.

66. Master Switch (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from master switch.
3. Disconnect electrical connector from master switch.
4. Remove screw securing master switch mounting bracket to case and remove master switch and mounting bracket.

5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.
2. Position master switch mounting bracket to case and install screw securing mounting bracket to case.
3. Connect electrical connector to master switch.
4. Install vacuum hoses to master switch.
5. Install trim panel inside luggage compartment.

67. Power Servo (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect multiple electrical connector from power servo.
3. Disconnect multiple vacuum connector from servo valve.
4. Disconnect vacuum hose from power servo vacuum power unit.
5. Disconnect temperature door link at temperature door arm.
6. Remove two screws securing power servo to case.
7. Remove power servo.

b. Installation

1. Position power servo into opening in case and secure with two screws.
2. Connect vacuum hose to power servo vacuum power unit.
3. Connect multiple vacuum connector to servo valve.
4. Connect multiple electrical connector.
5. Connect temperature door link and adjust as described in Note 53a.
6. Replace trim panel inside luggage compartment.

68. Power Servo Vacuum Valve (697 Rear)

a. Removal

1. Disconnect multiple hose connector.
2. Remove spring clip and one screw securing vacuum valve to power servo.
3. Remove vacuum valve.

b. Installation

1. Position vacuum valve on power servo and secure with one screw and spring clip.
2. Connect multiple hose connector.

69. Mode Door Assemblies

This procedure applies to both right and left mode door assemblies.

a. Removal

1. Remove trim panel inside luggage compartment.
2. Remove duct sensor electrical connector from right mode door assembly only.
3. Remove vacuum hose from mode door vacuum diaphragm.
4. Remove three nuts securing de-fogger duct to outlet grille on package shelf.
5. Loosen clamps securing mode door assembly to blower assembly, heater discharge and air conditioner discharge hoses.
6. Slide discharge hoses off of mode door assembly and lift assembly off of blower outlets.

b. Installation

1. Install mode door vacuum hose on diaphragm.
2. Position mode door assembly on blower outlet.
3. Position heater discharge and air conditioner discharge hoses on mode door assembly.
4. Secure mode door assembly on blower assembly by tightening clamp.
5. Secure heater discharge and air conditioner discharge hoses onto mode door assembly by tightening clamps.
6. Position de-fogger ducts to outlet grille on package shelf, retaining with three nuts.
7. Install duct sensor electrical connector into right mode door assembly only.
8. Install trim panel inside luggage compartment.

70. Transducer (697 Rear)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Disconnect vacuum hoses from fittings on transducer.
3. Disconnect transducer electrical connector.
4. Remove two screws securing transducer mounting bracket to evaporator case and remove transducer.

b. Installation

1. Position transducer to case and secure with two screws.
2. Connect transducer electrical connector.
3. Connect vacuum hoses to fittings on transducer.

NOTE: Vacuum hose with smallest I.D. goes on top fitting of transducer.

4. Replace trim panel inside luggage compartment.

71. Compressor Diode Assembly (697 Only)

The procedure for removing and installing the compressor diode assembly is described in Section 12, Note 76.

72. Blower Evaporator Assembly (697)

a. Removal

1. Remove trim panel inside luggage compartment.
2. Purge system as described in Note 5a.
3. Drain engine cooling system.
4. Raise rear of car and remove clamp securing evaporator drain and remove drain.
5. Disconnect right and left mode door assemblies from blower motors and disconnect tan vacuum hoses.
6. Disconnect ambient air hoses from blower evaporator assembly.
7. Disconnect ambient and duct sensor leads.
8. Disconnect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum supply hose at connector where they enter luggage compartment below blower evaporator assembly.
9. Disconnect six way electrical connector from body wiring at right side of car.
10. Disconnect yellow and black vacuum hoses at right side of car.
11. Unsnap return air boot from blower evaporator assembly.
12. Remove screw securing bracket to package shelf.
13. Remove four screws securing brackets to floor pan.
14. Lift blower evaporator assembly out of luggage compartment.

b. Installation

1. Position blower evaporator assembly in luggage compartment.
2. Connect right and left mode door assemblies to blower evaporator outlets.
3. Connect tan vacuum hoses.
4. Connect return air boot to blower evaporator case.
5. Connect yellow and black vacuum hoses at right side.
6. Connect six-way electrical connector at right side.
7. Connect heater supply and return hoses, air conditioner high and low pressure hoses, and vacuum hose at connectors under blower evaporator assembly. Refer to Fig. 1-83. Recover low pressure hose with insulation.
8. Connect ambient and duct sensor leads.
9. Connect ambient air hoses to blower evaporator.
10. Secure lower brackets to floor pan with four cap screws.
11. Secure upper bracket to package shelf with screw.
12. Raise rear of car and install evaporator drain assembly.
13. Fill engine cooling system.
14. Evacuate system as described in Note 5c.
15. Charge system as described in Note 5d.
16. Replace trim panel inside luggage compartment.

73. POA Suction Throttling Valve (697 Rear)

a. Removal

1. Remove blower evaporator assembly as described in Note 72a.
2. Remove screw securing suction throttling valve clamp to case assembly.
3. Disconnect equalizer line.
4. Disconnect low pressure line from suction throttling valve.
5. Disconnect suction throttling valve from evaporator outlet pipe.

b. Installation

1. Connect suction throttling valve to evaporator outlet pipe.
2. Connect low pressure line to suction throttling valve, and cover with insulation.
3. Connect equalizer line to suction throttling valve.
4. Secure suction throttling valve to case assembly with clip and one screw.
5. Install blower evaporator assembly as described in Note 72b.

74. Evaporator Core

a. Removal

1. Remove blower evaporator assembly as described in Note 72a.
2. Remove 29 screws and 4 nuts holding evaporator case together and remove bottom of case.
3. Remove screw and clamp securing high pressure line to bottom of case assembly.
4. Disconnect suction throttling valve from evaporator outlet pipe.
5. Disconnect equalizer line from suction throttling valve.
6. Remove ambient air inlet fittings from case.
7. Remove four screws on top of case securing evaporator core to case and remove evaporator core from case.
8. Remove expansion valve from evaporator core as described in Note 75a.

b. Installation

1. Install expansion valve to evaporator core as described in Note 75b.
2. Position evaporator core in case assembly and secure with four screws.
3. Install ambient air inlet fittings on case.

4. Connect suction throttling valve to evaporator outlet pipe.
5. Connect equalizer line to suction throttling valve.
6. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
7. Secure high pressure line to bottom of case with clamp and screw.
8. Install blower evaporator assembly as described in Note 72b.

75. Expansion Valve

a. Removal

1. Remove blower evaporator assembly as described in Note 72a.
2. Remove evaporator core assembly as described in Note 74a.
3. Remove power element bulb from evaporator outlet pipe.
4. Disconnect equalizer line from POA suction throttling valve.
5. Disconnect expansion valve from evaporator inlet.

b. Installation

1. Connect expansion valve to evaporator inlet.
2. Connect equalizer line to suction throttling valve.
3. Position power element bul orator outlet and secure.
4. Replace evaporator core assembly as described in Note 74b.
5. Replace blower evaporator assembly as described in Note 72b.

76. Heater Core

a. Removal

1. Remove blower evaporator assembly as described in Note 72a.
2. Remove inlet and outlet hoses from heater inlet and outlet pipes.
3. Remove 29 screws and 4 nuts securing evaporator case together.
4. Remove clamp and screw securing high pressure line to bottom of case.
5. Remove sealing grommet around heater inlet and outlet pipes.
6. Remove 6 screws securing temperature door baffle to case and remove baffle.
7. Remove 6 screws, 3 each side of case, securing heater core and baffle to case.
8. Lift heater core and baffle from case.
9. Remove 4 screws securing baffle to heater core and remove baffle.
10. Remove retainers from heater core.

b. Installation

1. Position retainers to heater core and secure baffle to retainers with 4 screws.
2. Position heater core in case and secure with 6 screws, 3 each side.
3. Install temperature door baffle.
4. Seal hole around heater inlet and outlet pipes with sealing grommet.
5. Position bottom of case on assembly and secure with 29 screws and 4 nuts.
6. Secure high pressure line to bottom of case with clamp and screw.
7. Install inlet and outlet hoses to heater core pipes.
8. Install blower evaporator assembly as described in Note 72b.

ELDORADO AIR CONDITIONER
GENERAL DESCRIPTION

The descriptive material and service information that follows will deal with the areas where the Eldorado air conditioner differs from the standard car system (Series 680-1-2-3). It can be assumed that in all other respects this system is the same as the standard system. Figures 1-90 and 1-91 show the location of most of the components.

Air Delivery System

The air delivery system is, in general respects, the same as the standard system -- outside or recirculating air is drawn into the system at the air inlet, directed through the evaporator, reheated as required in the heater and directed to either air conditioner, heater, or defroster outlets. A short description of each air delivery component follows:

a. Air Inlet

This assembly is similar to the standard unit except it has a two-stage vacuum actuator and the door has three positions instead of two.

b. Evaporator and Blower

This assembly is the same as the standard unit except the refrigerant-12 control valves are positioned differently to clear the Eldorado engine.

c. Heater and Air Modulator

The heater is basically the same as the standard unit except there is no "purge" door.

d. Mode Selector

This unit is very similar to the standard system "mode selector", except that general configuration and location of air doors is different.

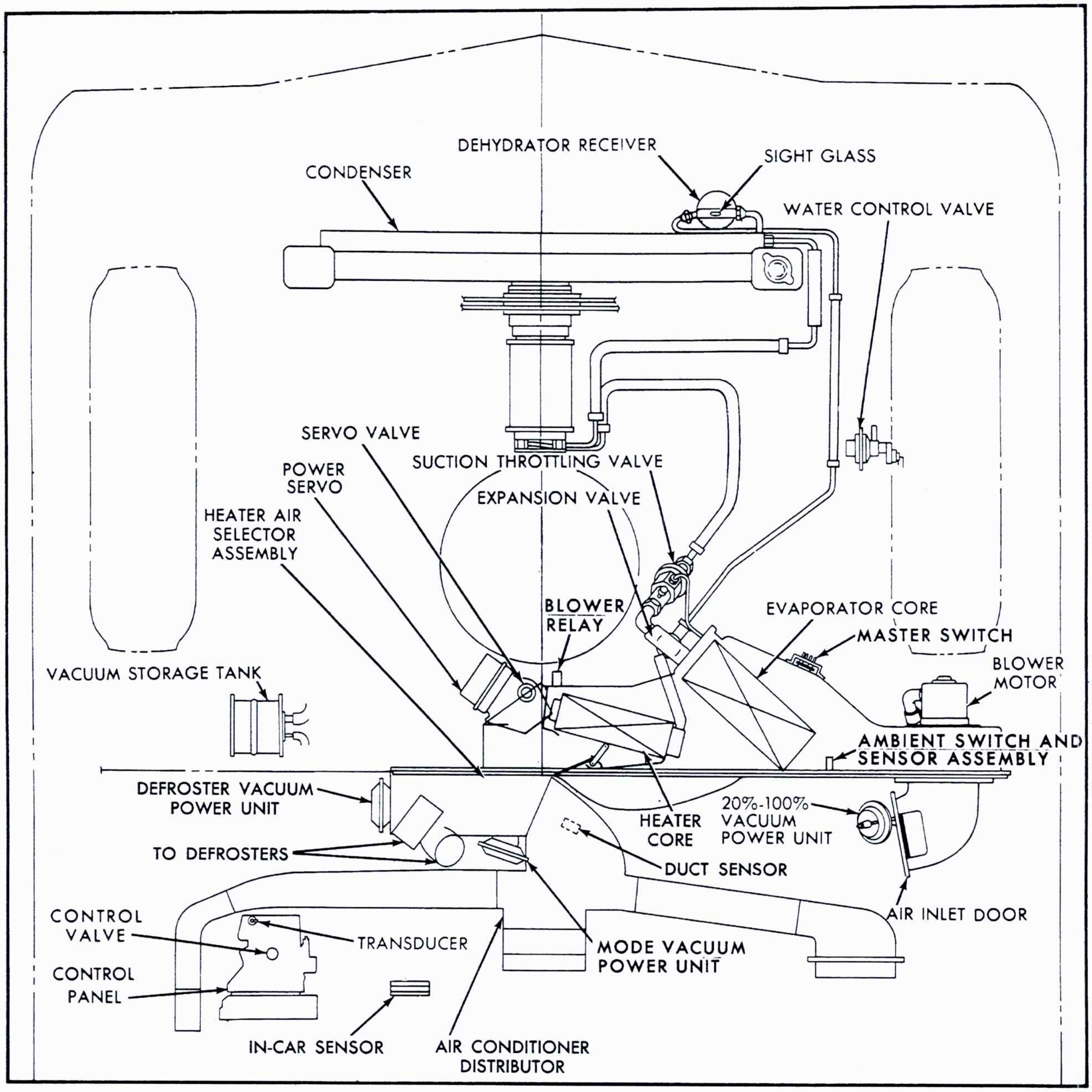


Fig. 1-90 Location of Air Conditioner Components - 693 Series

It does contain a mode door and a defroster door and related vacuum actuators. It does not utilize the defroster bleed actuator used on the standard unit; a fixed amount of air bleeds by the defroster door and flows to the windshield any time the system is in the heater mode.

e. Air Conditioner Distributor

This part is similar in general shape and location to the standard unit. It mounts to the right hand side of the air selector and directs air to the three air conditioner outlets.

f. Air Conditioner Outlets

The instrument panel outlets are identical to those in the standard system. Air flow to the floor area is provided by two small holes in the air distributor.

g. Heater Distributor

This unit attaches to the bottom of the air selector and functions the same as the standard unit.

Refrigeration System

The location and functioning of the various refrigeration components is almost identical to the standard system. The compressor, expansion valve and suction throttling valve are interchangeable with standard system units. The condenser,

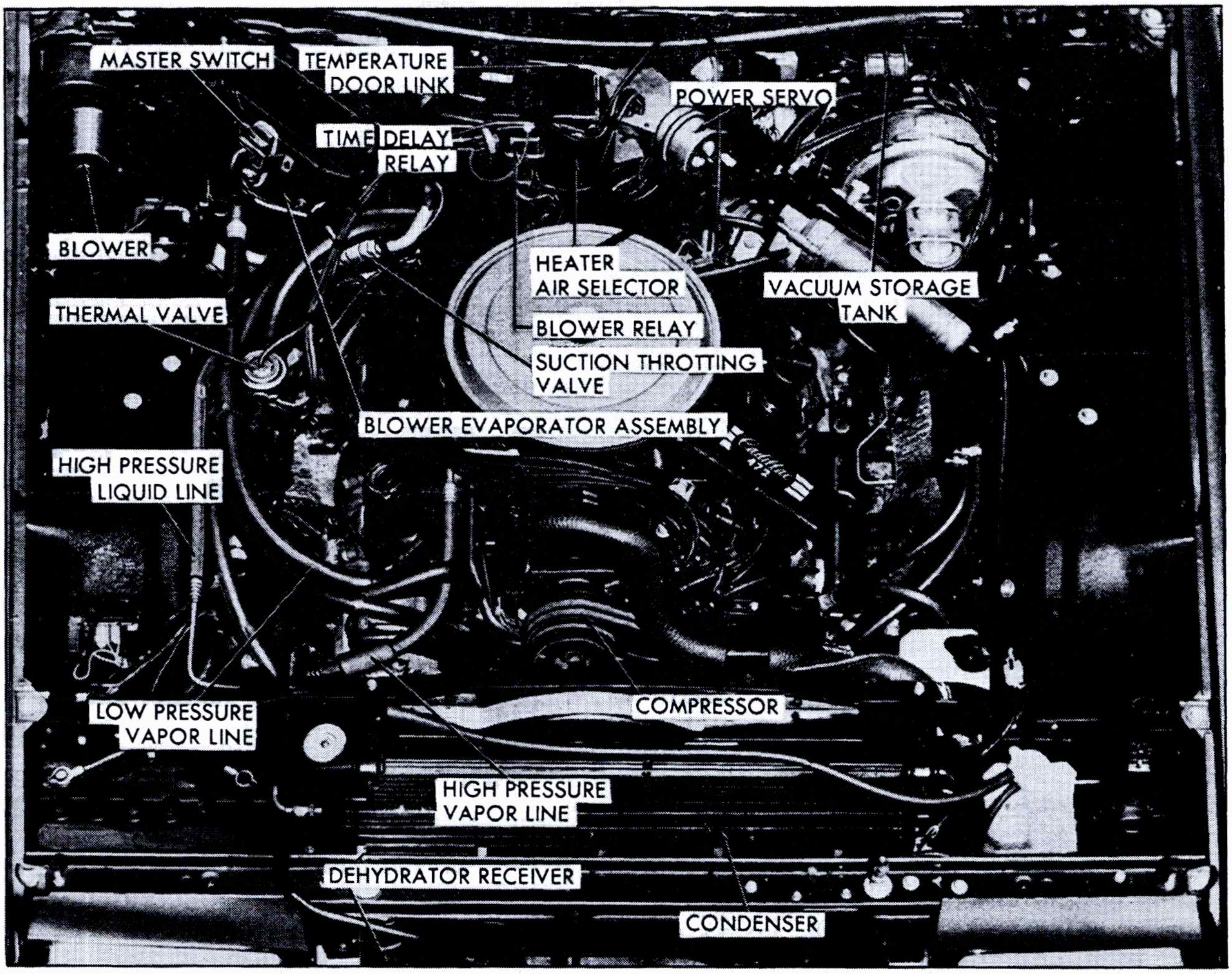


Fig. 1-91 Air Conditioner Underhood Units on Car - 693 Series

receiver and refrigerant lines are similar but not interchangeable.

Automatic Temperature Control System

Control Panel Settings

The control panel settings provided and the manner in which the system operates at these settings is identical to the standard system except that there is no "purging" of the evaporator and heater cases.

Control System Components

a. In-Car Sensor

This unit is identical to the standard unit in location, function and resistance value. The in-car temperature switch located in the sensor assembly in the standard system is not utilized in this system.

b. Discharge Air Sensor

This unit is identical to the standard unit as regards function and resistance value. It is located on top of the heater distributor and has a pick-up tube extending into the air conditioner distributor.

c. Ambient Sensor and Compressor Switch Assembly

This assembly is identical to the standard unit as regards function and sensor resistance value, but is located in the engine compartment on the right hand side of the cowl.

d. Control Panel Assembly

This assembly is the same as the standard unit with the following exceptions:

1. A different rotary vacuum valve is used to provide vacuum functions specific to this system.
2. The wiper contacts on the selector lever are different to provide electrical switching functions specific to this system. The circuit board switch is identical to the standard unit.
3. The wiring on the control head is specific. The amplifier, the transducer, the circuit board switch, and the control head calibration are identical to the standard unit.

e. Power Servo Assembly

This assembly is identical to the standard unit, except a different vacuum valve and different resistors are employed. The air-mix door link and dust cover are similar to the standard units but not interchangeable. The sequence of events in the control program governed by the power servo are the same as that described for the standard unit except that at the maximum air conditioning position the servo provides a vacuum feed to the master on-off switch, which will be described later, to provide system turn-on in hot weather.

f. Blower Relay

This unit differs from the standard unit in that it is a single pole-single throw relay. It is mounted in a similar location on the heater assembly.

g. Master On-Off Switch

This part, which is not used in the standard system, is a vacuum-actuated electrical switch in series with the blower motor. It must be closed to obtain blower operation. It is located on the evaporator case.

h. Thermal Vacuum Valve

This unit, which is not used on the standard system, is a wax-pellet-actuated vacuum valve located on the heater water valve. It passes vacuum when engine water flowing through the water valve is above 130°; below that temperature it blocks vacuum.

i. Vacuum Delay Relay Assembly

This assembly, which is not used on the standard system, consists of a vacuum relay, a porous metal restrictor and two short vacuum hoses which act in conjunction to cause a delay in vacuum passage of approximately 45 seconds. This assembly is in series with the thermal vacuum valve. It is located in the vacuum hose assembly in the engine compartment on the top of the heater case.

j. Vacuum Leakage Plug

This part, which is not used on the standard system, is a small, rivet-shaped, porous-metal plug located in the end of a purple hose at the air inlet actuator in the right hand shroud side. Its function is to give positive leakdown of the system vacuum when the car is not operated.

k. Vacuum Check Valve

This unit has the same function as that of the standard system unit and is similar in construction except that it has no auxiliary connections. It is located in the vacuum hose assembly at the left hand end of the heater assembly.

l. Heater Water Valve

This valve performs the same function as the standard unit -- it blocks or passes water to the heater core. It differs from the standard unit in that it is located on the right hand wheelhouse, has provisions for the attachment of the thermal vacuum valve and is normally open (it closes when vacuum is applied).

m. Vacuum Storage Tank

This unit is identical to the standard unit in all respects.

n. Vacuum Hose Assembly

This assembly has connections and routings completely different from the standard system. It is a one-piece assembly; no bulkhead connector is utilized.

Control System Operation

The Eldorado temperature control system, like the standard system, is made up of four major sections which perform the following operations:

1. Temperature control.
2. System turn-on.
3. Blower speed control.
4. Auxiliary vacuum and electrical functions.

a. Temperature Conrrol Circuit

This circuit is identical to that of the standard system -- three sensors develop an electrical signal which is amplified by the amplifier and applied to the transducer which produces a modulated vacuum to position the power servo.

b. System Turn-On Circuit

Like the standard system, turn-on occurs in three ways:

1. Delayed turn-on in cold weather until engine water is hot.

2. Immediate turn-on when the car interior is warm requiring air conditioner operation, and --

3. Immediate turn-on, even with cold engine water, by owner override to the "Vent", "Fog" or "Ice" lever setting.

The mechanics of sytem turn-on, however, are different than those used on the standard system. Turn-on is accomplished by applying vacuum to the master on-off switch which closes an electrical switch inside this assembly and completes the circuit to the blower and by simultaneously applying this same vacuum to the air inlet actuator so that it positions the inlet door so that outside or recirculating air can be drawn into the system by the blower.

Cold weather delay is accomplished by the thermal vacuum valve which blocks the application of this vacuum to the master on-off switch and the air inlet actuator until engine water is warm.

Immediate turn-on in hot weather is accomplished by the power servo. When it is positioned in the maximum air conditioning position, it feeds vacuum directly to the master switch and air inlet from vacuum valve port #2, thereby bypassing the thermal vacuum valve. It is possible for the power servo to be positioned at maximum air conditioning in cold weather at car start-up, as a result of leakdown of vacuum in the storage tank. To prevent the power servo from sending the bypass vacuum signal to the master switch and air inlet in this situation, a .036 diameter restriction has been incorporated in the inlet nipple of the check valve to slow down the application of vacuum sufficiently to allow the power servo to move away from the maximum air conditioning position.

When the owner positions the lever at "Vent", "Fog" or "Ice", vacuum from port #5 on the control head vacuum valve is fed directly to the master switch and air inlet, again bypassing the thermal vacuum valve.

The vacuum delay relay also plays a part in system turn-on. It delays vacuum passage to the thermal vacuum valve for approximately 45 seconds, thereby preventing system turn-on for that period of time, even though engine water is hot. This short delay is necessary to allow the refrigeration system, which operates during this time, to precondition the air in the evaporator case by reducing its temperature and humidity.

c. Blower Speed Control Circuit

Like the standard system, three ranges of blower speed are utilized, as listed below:

1. Fixed lower blower (at "Vent" and "Lo").
2. Four blower speeds automatically selected by the power servo (at "Auto" and "Fog").
3. Fixed high blower (at "HI" and "Ice").

The electrical circuits supplying current to the blower can be traced in the diagram in Fig. 1-92. At "Vent" and "Lo" current flows from the ignition switch to the 10 amp fuse in the fuse block and through all four resistors in the power servo to the master switch and blower.

At "Auto" and "Fog" the blower relay is energized from a circuit pad on the control head circuit board switch and current flows from the battery terminal on the starter solenoid to the relay to the sliding wiper on the power servo which switches in resistance according to its position and to the master switch and blower.

At "Hi" and "Ice" the relay is again energized and current flows from the relay to two interconnected pads on the control head circuit board switch and blower, without any resistors in the circuit.

Unlike the standard system, the blower does not operate in the "Off" setting of the control panel and "purging" of the evaporator and heater cases does not occur.

d. Auxiliary Vacuum and Electrical Function Circuits

Like the standard system, the system performs a number of functions not related directly to discharge temperature control, to turn-on circuitry or to blower speed control. These are same as the standard system except that there is no defroster bleed arrangement and the reaction of some of the vacuum actuators is opposite to that of the standard system parts. The auxiliary functions are:

1. Defroster door actuation.
2. Recirc. door actuation.
3. Mode door actuation.
4. Heater water valve control.
5. Operation of the compressor.

The defroster door, the recirc. door, the mode door and the heater water valve are all actuated by vacuum applied from either the control head vacuum valve or the power servo vacuum valve. Vacuum valve internal connections are illustrated in Fig. 1-92. The sense of the defroster actuation is the opposite of that used in the standard system -- the actuator must be vented to obtain defroster air delivery. The sense of the heater water valve actuation is the reverse of the standard system -- the valve is normally open and vacuum must be applied to close it off. The recirc. door actuation is also different in that a two-state actuator is used and there are three door positions.

Compressor actuation is identical to that of the standard system.

Electrical and Vacuum Circuit Diagrams

Complete electrical and vacuum circuit diagrams for the Eldorado air conditioner are shown in Fig. 1-92 and Fig. 1-94. The instructions in the standard system section which describe how to use electrical and vacuum diagrams by positioning control head and power servo electrical wiper pads and by showing interconnects in the control head and power servo vacuum valves can be applied to the Eldorado circuits to understand system operation and to diagnose problems.

SERVICE INFORMATION

NOTE: Standard service procedures listed earlier in this section for the Series 680-1-2-3 air conditioning system also apply to the Eldorado system.

77. Duct Sensor (693 Only)

a. Removal

1. Disconnect electrical connector from duct sensor.
2. Remove three screws securing heat distributor to dash and to heater air selector and remove heat distributor.

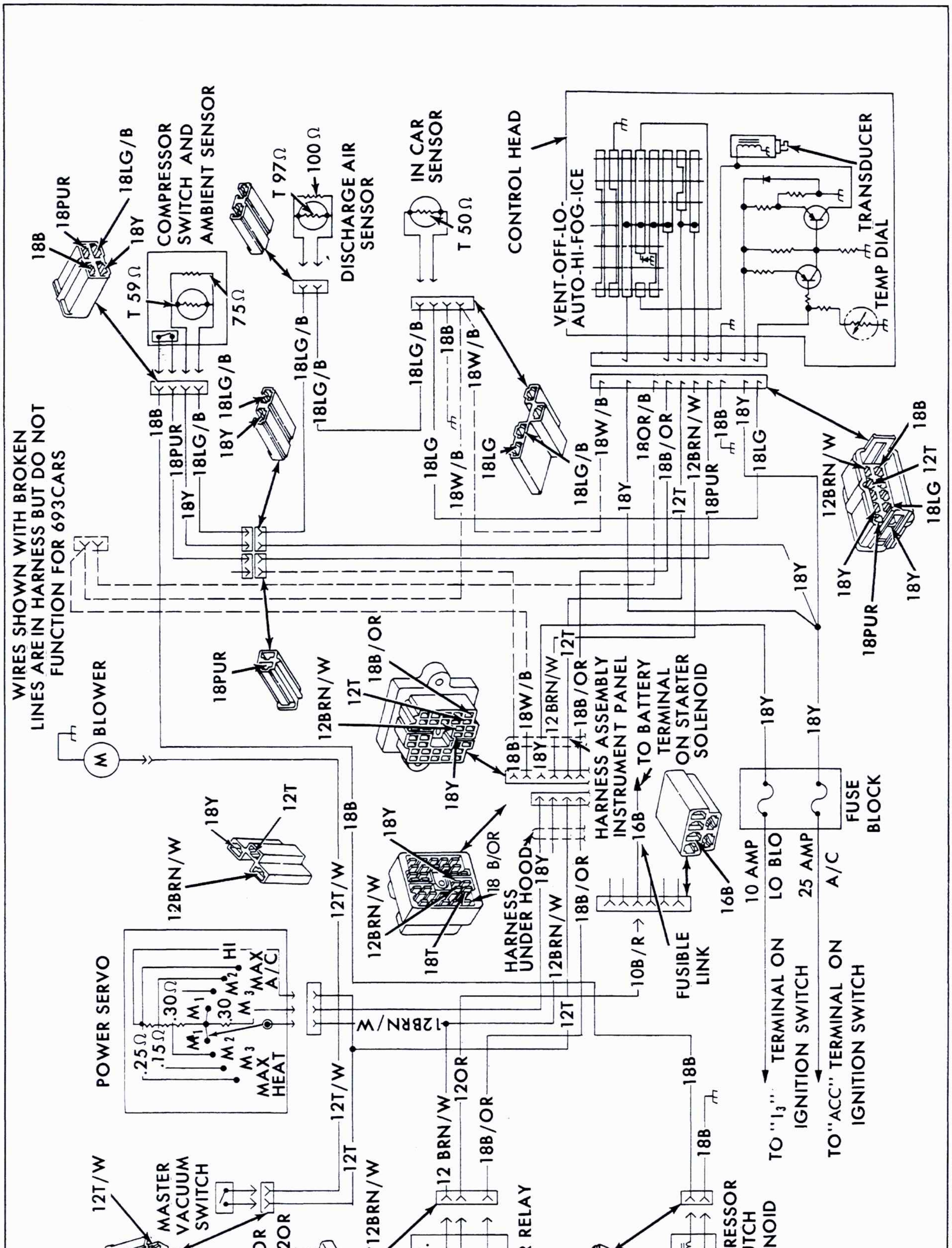


Fig. 1-92 Automatic Climate Control Circuit Diagram - 693 Series

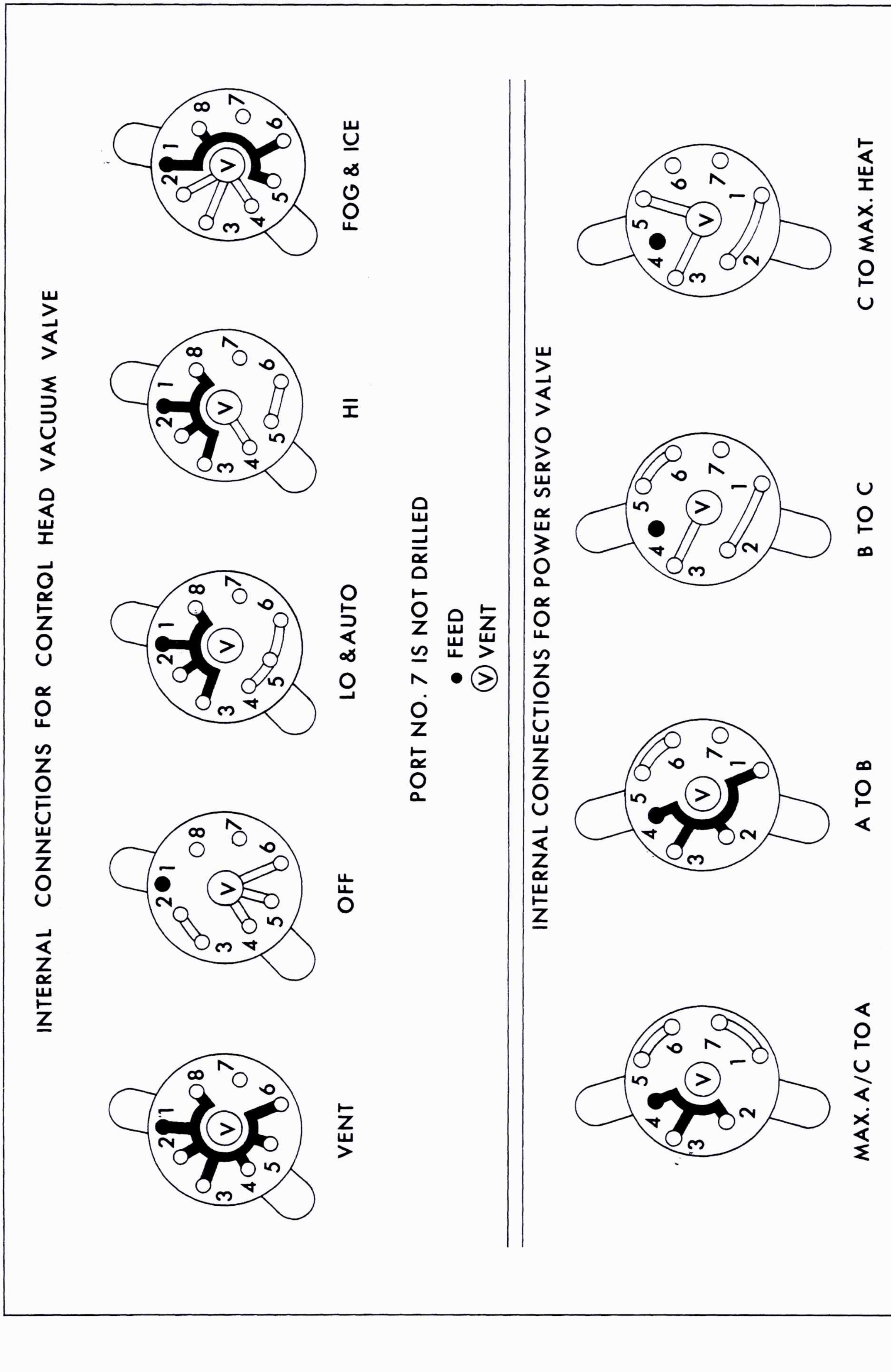


Fig. 1-93 Rotary Vacuum Valve Internal Connections - 693 Series

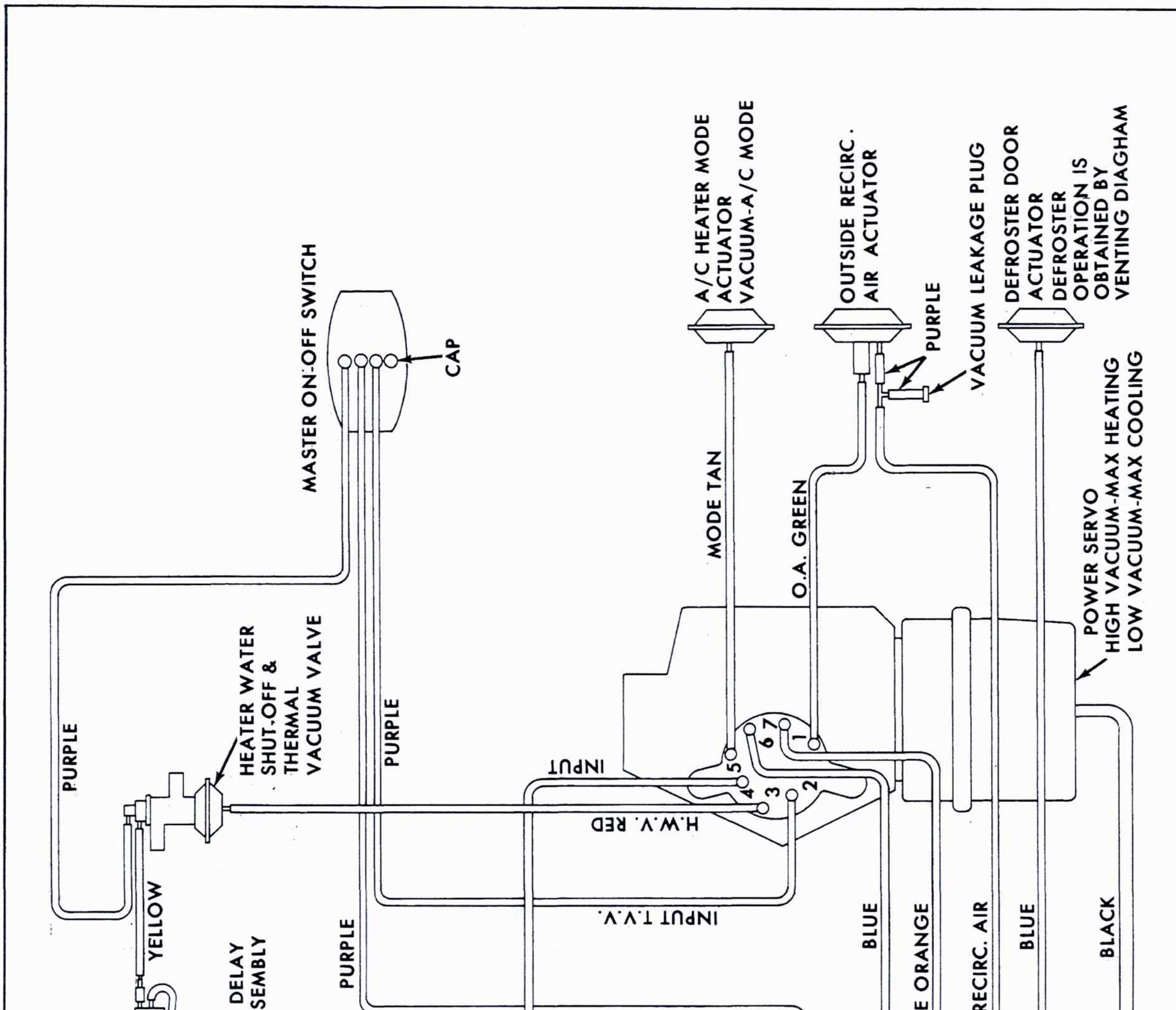


Fig. 1-94 Automatic Climate Control Vacuum Schematic - 693 Series

3. Remove screw securing duct sensor to heat distributor and remove sensor.

b. Installation

1. Position duct sensor on heat distributor and secure with one screw.
2. Position heat distributor to dash panel and heater air selector with duct sensor tube protruding into air conditioning distributor. Secure with three screws.
3. Connect electrical connector to duct sensor.

78. Ambient Switch and Sensor Assembly

a. Removal

1. Open hood.
2. Disconnect Ambient Switch and Sensor connector from harness.
3. Remove two screws securing Ambient Switch and Sensor Assembly to cowl panel and remove sensor and gasket.

b. Installation

1. Position Ambient Switch and Sensor Assembly, and gasket, to cowl panel and secure with two screws.
2. Connect electrical connector to harness connector.
3. Seal the ambient switch and sensor assembly to prevent entrance of moisture.
4. Close hood.

79. Master Switch

a. Removal

1. Disconnect vacuum hoses from master switch.
2. Disconnect electrical connector from master switch.
3. Remove two screws securing master switch mounting bracket to evaporator case and remove master switch and mounting bracket.
4. Uncap unused port of master switch.
5. Separate mounting bracket from master switch.

b. Installation

1. Install mounting bracket on master switch.
2. Place cap on one port of master switch.
3. Position master switch mounting bracket to evaporator case and install two screws securing mounting bracket to evaporator case.
4. Connect electrical connector to master switch.
5. Install vacuum hoses to master switch.

80. Blower-Evaporator Assembly

a. Removal

1. Remove carburetor air cleaner.
2. Purge system as described in Note 5a.
3. Remove blower motor assembly as described in Note 31a.
4. Disconnect high pressure liquid line at expansion valve, and cap line.
5. Disconnect low pressure vapor line at suction throttling valve, and cap line.
6. Remove vacuum hoses from retaining clips on cowl, and position hoses toward engine.
7. Remove horseshoe clip retaining water control valve to mounting bracket and move water control valve, with all hoses attached to engine.
8. Remove six screws securing heater-air selector assembly to cowl and pull assembly away from cowl and position toward left side of car as far as possible.
9. Remove eight screws securing blower-evaporator assembly to cowl and remove assembly through engine compartment by pulling lower left corner toward engine and upward. Note screw securing blower motor ground wire to cowl. Disconnect vacuum hoses and electrical connector from master switch before removing assembly.

b. Installation

1. Inserting blower end of assembly under right hood hinge, position blower-evaporator assembly to cowl by pushing left side of assembly downward, inward and to the right.
2. Making certain that no vacuum hoses are trapped between wheel housing and assembly, or underneath assembly, install screws securing assembly to cowl, after installing blower motor ground wire to appropriate screw.
3. Position heater-air selector assembly to cowl and to blower-evaporator assembly and install screws securing heater-air selector assembly to cowl.
4. Using body caulking compound, seal units to prevent air leaks.
5. Position water control valve to mounting bracket and install horseshoe retaining clip.
6. Using a new O-ring, connect high pressure liquid line to expansion valve.
7. Connect low pressure vapor line to suction throttling valve, using a new O-ring.
8. Position vacuum hoses to retaining clips on cowl.
9. Install blower motor assembly as described in Note 31b.
10. Make sure that all vacuum hoses and electrical connectors in work area are connected securely.
11. Install carburetor air cleaner.
12. Evacuate system as described in Note 5c.
13. Charge system as described in Note 5d and leak test all connections.
14. Check operation of system.

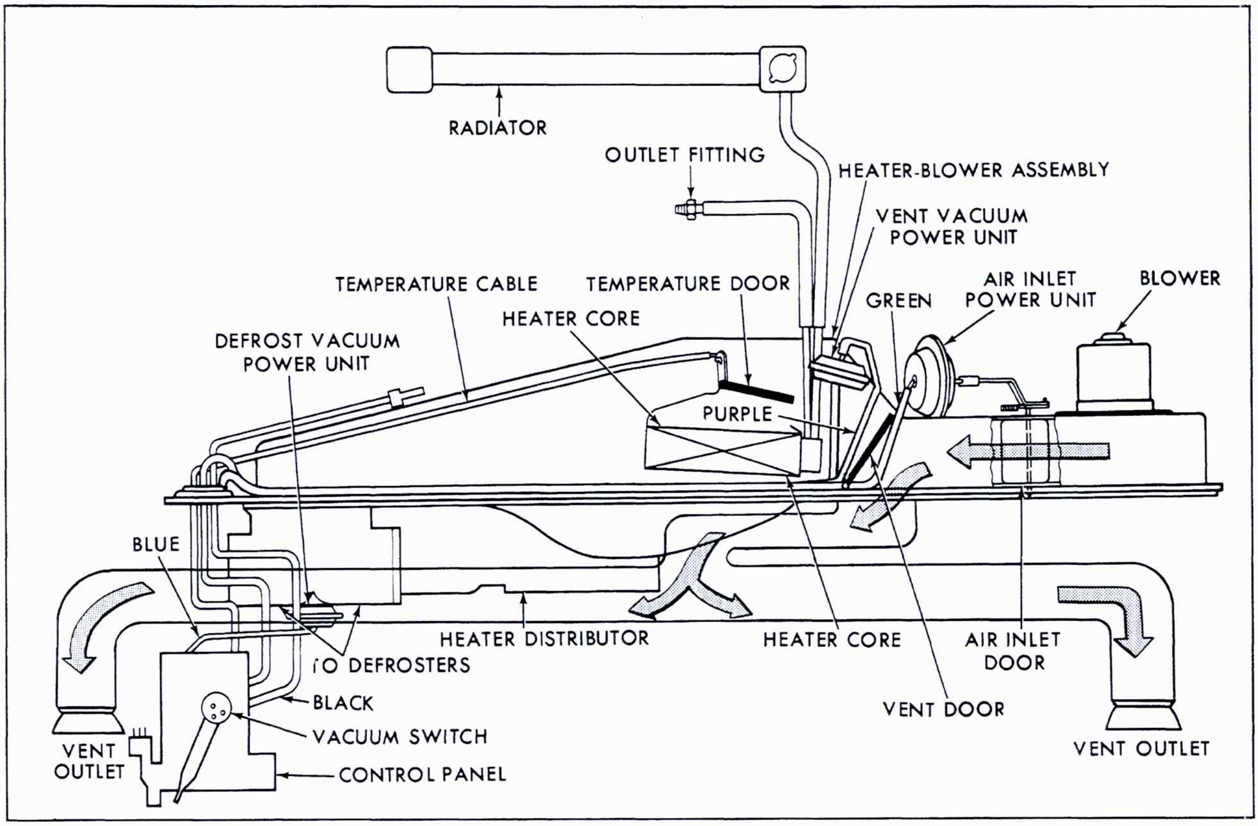


Fig. 1-95 Upper Level Vent System - 693 Series

ELDORADO HEATER ONLY
GENERAL DESCRIPTION

The descriptive material and service information that follows will deal with the areas where the Eldorado heater differs from the standard car heater (Series 680-1-2-3). It can be assumed that in all other respects this system is the same as the standard system. Fig. 1-95 is an overall diagram of the Eldorado heater which shows the location of most of the components.

The Eldorado heating system differs substantially from the standard system in that it provides upper level ventilation for the passenger compartment in warm weather in addition to providing conventional heating and defrosting in cold weather.

The heater and blower assembly, mounted on the cowl in the engine compartment, is functionally the same as the standard unit except that it incorporates an extra door and vacuum actuator which, when moved to the position shown in Fig. 1-95, diverts airflow from the blower into the ventilation duct and to air outlets located at each end of the instrument panel. These air outlets are the same as those used on the standard heating system.

The heater control panel is the same as the standard control except that the "Heat-Defrost" lever has an additional setting labeled "Vent". To operate the upper level ventilation system, the lever is set to "Vent" and the fan switch lever is used to control airflow as required. See Fig. 1-96.

Lower level ventilation outlets in the left hand and right hand shroud sides are also provided. Shut-off valves in these outlets are controlled by push-pull knob and cable assemblies located at the ends of the instrument panel.

Ventilation exhaust grilles are located in the door lock pillars. Air flows under the rear seat into the trunk and through body passage-ways to these exhaust grilles.

The electrical diagram for this system is shown in Fig. 1-81.

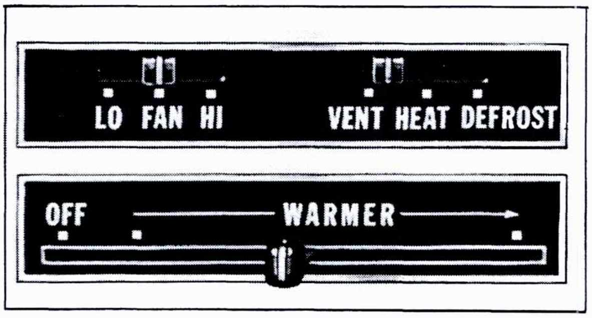


Fig. 1-96 Heater Control Panel - 693 Series

SERVICE INFORMATION

81. Blower Resistor (693 Heater Only)

a. Removal

1. Disconnect multiple connector from blower resistor.
2. Remove two screws securing blower resistor to heater case and remove resistor.

b. Installation

1. Position blower resistor on heater case and secure with two screws.
2. Connect electrical connector to blower resistor.

82. Heater Blower Motor (693)

a. Removal

1. Remove rubber cooling hose from nipple and blower motor.
2. Disconnect electrical connector from blower terminal.
3. Remove five screws securing blower to heater case and remove blower.

b. Installation

1. Place a bead of sealer around opening where blower will contact case.
2. Position blower on case and secure with five screws.
3. Connect electrical connector to blower terminal.
4. Install cooling hose on motor and nipple.

83. Heater-Blower Assembly (693)

a. Removal

1. Drain cooling system.
2. Remove blower motor as described in Note 82a.
3. Remove left cowl to fender shield strut rod.
4. Remove heater hoses from fittings on heater-blower assembly leaving clamps on fittings.
5. Disconnect temperature bowden cable from temperature door operating lever and bracket. Position cable out of way.
6. Disconnect multiple connector from blower resistor.
7. Disconnect vacuum hoses from outside air door and vent diaphragms and position out of way.
8. Remove 12 screws securing heater-blower assembly to cowl.
9. Pull heater-blower assembly away from cowl and tipping blower end downward remove assembly from car.

b. Installation

1. Place gasket around mounting flange where heater blower assembly will contact cowl.
2. Place heater-blower assembly to cowl and secure with 12 screws. The retainer clips directly behind the engine attach to the screw at the lower edge of the heater-blower assembly.
3. Connect multiple electrical connector to blower resistor.
4. Connect vacuum hoses to the outside air door and vent diaphragms. The purple hose attaches to the vent diaphragm.
5. Install temperature bowden cable and adjust.
6. Connect heater hoses to nipples on front of heater blower assembly.
7. Install blower motor as described in Note 82b.
8. Install left cowl to fender shield strut rod.
9. Fill cooling system.

84. Heater Core (693)

a. Removal

1. Remove heater blower assembly as described in Note 83a.
2. Remove four screws, two each side of heater core, securing wire retaining clamps to heater-blower case, and remove retaining clamps.
3. Pull heater core out of heater-blower case.

b. Installation

1. Form a bead of heavy bodied sealer around flange in heater-blower case that heater core contacts.
2. Position heater core in heater-blower case and secure with two wire retainers and four screws.
3. Check position of rubber grommets where nipples pass through heater-blower case. Reposition as required for sealing.
4. Install heater-blower assembly as described in Note 83b.

TORQUE SPECIFICATIONS—METAL TUBING

Metal Tube O.D. (Inch Lbs.)	Thread and Fitting Size (Inch Lbs.)	Steel Tubing Torque (Ft. Lbs.)	Alum. or Copper Tubing Torque (Ft. Lbs.*)	Nominal Torque Wrench Span (Inch Lbs.)
1/4"	7/16"	15	7	5/8"
3/8"	5/8"	35	13	3/4"
1/2"	3/4"	35	13	7/8"
5/8"	7/8"	35	21	1-1/16"
3/4"	1-1/16"	35	28	1-1/4"

*Torque taken with crow foot attachment at a 90° angle on torque wrench.

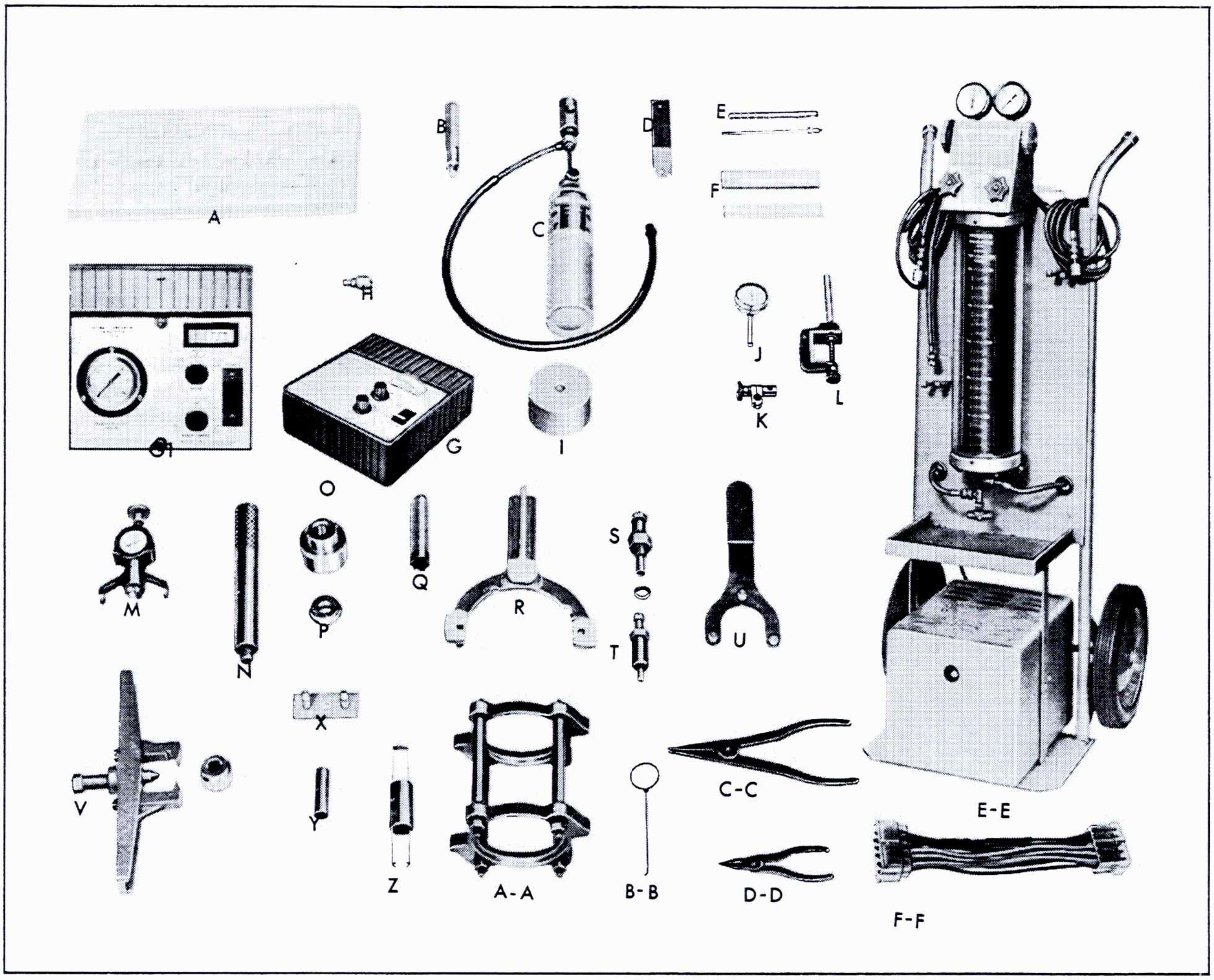


Fig. 1-97 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-9402	Parts Tray	Q	J-9392	Seal Remover and Installer
B	J-9432	Needle Bearing Installer	R	J-9396	Holding Fixture
C	J-6084	Leak Detector Torch	S	J-9401	Clutch Plate and Hub Assembly Remover
D	J-21530	Temperature Dial Adjuster			
E	J-5421	Thermometer	T	J-9480	Clutch Plate and Hub Assembly Installer (2 pcs.)
F	J-6076	Humidicator			
G	J-21512	Automatic Climate Control Tester	U	J-9403	Clutch Hub Holding Tool
			V	J-8433	Pulley Puller
G1	J-22368-01	Automatic Temperature Control Tester	W	J-9395	Puller Pilot
			X	J-9399	9/16" Thin Wall Socket
H	J-5420	Gage Adapter (2 Required)	Y	J-9527	Test Plate
I	J-9521	Internal Assembly Support	Z	J-9393	Seal Seat Remover and Installer (2 pcs.)
J	J-8001-3	Dial Indicator			
K	J-8001-2	Sleeve	A-A	J-9397	Compressor Fixture
L	J-8001-1	Clamp	B-B	J-5139	Oil Pick-Up Tube Remover
M	J-7316	Tension Gage	C-C	J-6435	Snap Ring Pliers (#26)
N	J-8092	Universal Handle	D-D	J-5403	Snap Ring Pliers (#21)
O	J-9398	Pulley Bearing Remover	E-E	J-8393	Charging Station
P	J-9481	Pulley and Bearing Installer	F-F	J-23189	A/C Harness Adapter